Transportation Impact Study for the Creekstone Senior Living Project

Prepared for the Town of Loomis

Submitted by
W-Trans

February 27, 2025

TRAFFIC ENGINEERING
TRANSPORTATION PLANNING
Balancing Functionality and Livability since 1995
w-trans.com

This page intentionally left blank

Table of Contents

Appendices

Executive Summary

The Creekstone Senior Living project is a 117-unit senior housing development proposed to be located at 3400 Chisom Trail in the Town of Loomis. The housing units would be divided into 18 independent living "cottage" units, 64 independent living apartment units, and 35 assisted living apartment units. The 99 apartment units would be grouped together into one building with 61 auto parking spaces and two motorcycle spaces and accessed via two driveways on Chisom Trail and one driveway on Boyington Road, whereas the 18 cottage units would each have a one-car garage and driveway with four communal guest spaces and would be accessed via a cul-de-sac extending from Boyington Road. In total, the project would be estimated to generate an average of 272 trips per day, including 13 a.m. peak hour and 23 p.m. peak hour trips.

The project would need to include sidewalks along the Chisom Trail and Boyington Road frontages, curbs and gutters on the Boyington Road frontage, and at least six bicycle parking spaces in order to have a less-than-significant impact with respect to pedestrian, bicycle, and roadway facilities. The impact of the project on transit facilities would be less than significant.

Due to the nature of the typical project resident, the project is estimated to have a vehicle miles traveled (VMT) per capita rate that is approximately half of the Town of Loomis average. As this would be less than 85 percent of the Town average (the applied threshold of significance), the project would be expected to have a less-than-significant impact on VMT.

Several sight-distance restrictions were observed for the two proposed project access locations on Boyington Road. Clearing the foliage on the inside of the horizontal curve on Boyington Road along the project frontage would open these sightlines to the distance required to avoid a significant impact. Sightlines at the two proposed access locations on Chisom Trail are sufficient. Traffic associated with the project would not warrant installation of a left-turn lane at any of the four project access points or at Boyington Road/Chisom Trail. Additionally, the project's impact on queueing at nearby intersections would be less than significant with the addition of project traffic to the roadway network under both existing and future volumes.

The project would have a less-than-significant impact with regard to emergency access and response times and would not present an adverse effect on traffic operations at nearby intersections.

The proposed parking supply would satisfy Town requirements for the total number of spaces and number of covered spaces provided, although as more spaces would be provided than required, a minor use permit and approval from the Town of the project's pedestrian and landscaping amenities would need to be secured. Additionally, to comply with accessibility requirements, at least one van-accessible parking space should be provided for the independent living cottages' visitor parking.

Introduction

This report presents an analysis of the potential traffic impacts and adverse operational effects that would be associated with development of the proposed Creekstone Senior Living project to be located at 3400 Chisom Trail in the Town of Loomis. The traffic study was completed in accordance with the criteria established by the Town of Loomis and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide Town staff and policy makers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to an acceptable level under CEQA, the Town's *General Plan*, or other policies. This report provides an analysis of those items that are identified as areas of environmental concern under the California Environmental Quality Act (CEQA) and that, if significant, require an EIR. Impacts associated with access for pedestrians, bicyclists, and to transit; the vehicle miles traveled (VMT) generated by the project; potential safety concerns such as increased queuing in dedicated turn lanes, adequacy of sight distance, or need for turn lanes; and emergency access are addressed in the context of the CEQA criteria. While no longer a part of the CEQA review process, vehicular traffic service levels at key intersections were evaluated for consistency with *General Plan* policies by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on anticipated travel patterns specific to the proposed project, then analyzing the effect the new traffic would be expected to have on the study intersections and need for improvements to maintain acceptable operation. The adequacy of parking is also addressed as a policy issue.

Applied Standards and Criteria

The report is organized to provide background data that supports the various aspects of the analysis, followed by the assessment of CEQA issues and then evaluation of policy-related issues. The CEQA criteria evaluated are as follows.

Would the project:

a. Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?
b. Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?
c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
d. Result in inadequate emergency access?

Project Profile

The project as proposed includes the construction of a variety of senior housing types including 18 independent living "cottage" (duplex) units, 64 independent living apartments, and 35 assisted living apartments on a site that is currently undeveloped. The project site is located at 3400 Chisom Trail, as shown in Figure 1.

lms001.ai 6/24

Transportation Impact Study for the Creekstone Senior Living Project

Figure 1 – Study Area and Existing Lane Configurations

Transportation Setting

Study Area and Periods

The study area varies depending on the topic. For pedestrian trips it consists of all streets within a half-mile of the project site that would lie along primary routes of pedestrian travel, or those leading to nearby generators or attractors. For bicycle trips it consists of all streets within one mile of the project site that would lie along primary routes of bicycle travel. For the safety and operational analyses, it consists of the project frontage and the following intersections:

1. King Road/Boyington Road
2. Boyington Road/Chisom Trail
3. Penryn Road/I-80 West Ramps-Boyington Road
4. Penryn Road/I-80 East Ramps-Boulder Creek Road

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 2:30 and 6:00 p.m. and typically reflects the highest level of congestion during the school dismissal or homeward bound commute. Counts were obtained for the study intersections were obtained in May 2024 when local schools were in session. It is noted that the p.m. peak hour was measured as 3:30 p.m. to 4:30 p.m. for all four intersections, which includes the dismissal time of the adjacent Del Oro High School.

Study Intersections

King Road/Boyington Road is a tee-intersection with stop controls on the southbound Boyington Road approach. There are bicycle lanes in both directions on King Road and 35-mile-per-hour (mph) speed limits in all directions.

Boyington Road/Chisom Trail is an uncontrolled three-legged intersection, though Chisom Trail has prima facie yield control as a terminating street per California Vehicle Code Section 21800. There is a posted speed limit on Boyington Road of 35 mph and no posted speed limit on Chisom Trail.

Penryn Road/I-80 West Ramps-Boyington Road is a signalized intersection with four legs and protected left-turn phasing for northbound and southbound traffic on Penryn Road. The Boyington Road and I-80 West Off-Ramp approaches have split phasing. Painted crosswalks are present on the east, west, and north legs of the intersection. Pedestrian ramps with truncated domes are also present at the intersection along with pedestrian phasing. There are 35-mph speed limits posted on Boyington Road and Penryn Road.

Penryn Road/I-80 East Ramps-Boulder Creek Road is a four-way intersection with stop controls on the eastbound and westbound approaches and no controls posted on the northbound and southbound (Penryn Road) approaches. A speed limit of 35 mph is posted on Penryn Road.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is October 2018 through September 2023.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2021 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same environment (urban, suburban, or rural), with the same number of approaches (three or four), and the same controls (all-way stop, two-way stop, or traffic signal). All of the study intersections had collision rates that are below the statewide average for the five-year study period, except for the intersection of Penryn Road/I-80 East Ramps-Boulder Creek Road which was also above the statewide average injury rate for similar intersections. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2018-2023)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. King Rd/Boyington Rd	1	0.10	0.13
2. Boyington Rd/Chisom Trl	0	0.00	0.0
3. Penryn Rd/I-80 W Ramps-Boyington Rd	10	0.54	0.55
4. Penryn Rd/I-80 E Ramps-Boulder Creek Rd	13	**0.77**	0.36

Note: c/mve = collisions per million vehicles entering; **Bold** = collision rate higher than the statewide average for similar facilities

Of the 13 collisions that occurred at the intersection of Penryn Road/I-80 East Ramps-Boulder Creek Road, five were broadsides, hit objects accounted for three collisions, two were sideswipes, and overturn, head-on, and rear-end accounted for one collision each. Six of these collisions were primarily attributed to a vehicle right-of-way violation, along with four to driving under the influence, two to driving at unsafe speeds, and one to unsafe starting or backing. To potentially reduce the number of collisions resulting from right-of-way violations, a "Cross Traffic Does Not Stop Sign" placard could be added below the existing stop signs to notify eastbound and westbound drivers to not expect traffic on Penryn Road to slow for cross traffic. Due to the number of driving under the influence incidents, increased enforcement in the area may also reduce collisions.

Four collisions involved an eastbound driver turning onto Penryn Road and being hit by a southbound vehicle. One contributing factor may be that sight lines between eastbound drivers and southbound traffic can be blocked by the freeway entrance sign on the northwest corner. Either moving or raising this freeway entrance sign may therefore improve visibility and reduce the potential for collisions at this intersection.

Project Data

The proposed project would include a mix of senior independent living and assisted living units. The independent living component would include a total of 82 units consisting of 18 two-bedroom cottages, eight two-bedroom apartments, 43 one-bedroom apartments, and 13 studios. The assisted living component would include a total of 35 units consisting of 20 one-bedroom apartments and 15 studio apartments. The proposed project site plan is shown in Figure 2.

Trip Generation

For purposes of estimating the trip generation for the project, standard rates published by the Institute of Transportation Engineers in the *Trip Generation Manual*, 11th Edition, 2021, were applied. The trip generation associated with the project's 82 independent living units was based on the "Congregate Care" land use (ITE LU #253). Consistent with ITE's description of the Congregate Care land use, the project would include centralized amenities for all residents including dining facilities, housekeeping, communal transportation, and organized social and recreational activities. Trips associated with the 35 assisted living units were estimated using ITE rates for the "Assisted Living" land use (ITE LU #255). The ITE rates for Assisted Living are based on the number of beds rather than the number of units; because all of the project's assisted living units would be either one-bedroom units or studios, the number of units was presumed in this case to equal the number of beds. Note that both Congregate Care and Assisted Living trip generation rates are inclusive of all site trips, including those made by employees, visitors, deliveries, and residents, though most residents cannot drive.

Based on the application of these rates, the project would be expected to generate an average of 272 trips daily, including 13 a.m. peak hour trips and 32 trips during the p.m. peak hour. These results are summarized in Table 2.

Table 2 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Congregate Care	82 du	2.21	181	0.08	7	4	3	0.18	15	7	8
Assisted Living	35 beds	2.60	91	0.18	6	4	2	0.24	8	3	5
Total			**272**		**13**	**8**	**5**		**23**	**10**	**13**

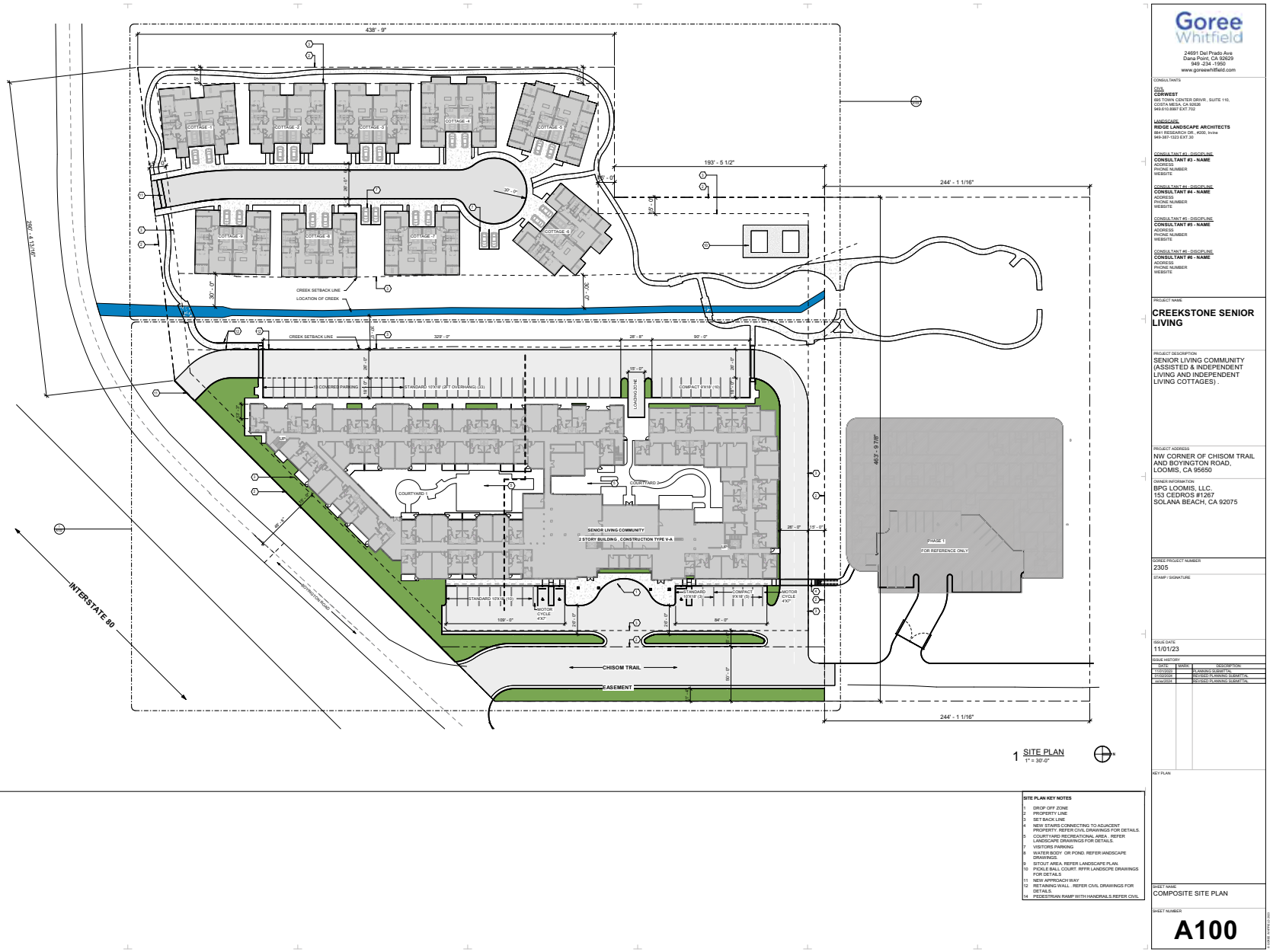
Note: du = dwelling unit

Trip Distribution

The pattern used to allocate new project trips to the street network was based on local knowledge of the study area and nearby destinations for residents as well as homes of potential employees. The applied distribution assumptions and resulting trips are shown in Table 3.

Table 3 – Trip Distribution Assumptions

Route	Percent	Daily Trips	AM Trips	PM Trips
I-80 To/From the West of Penryn Rd	50%	136	7	11
King Road To/From the West of Boyington Rd	30%	82	4	7
I-80 To/From the East of Penryn Rd	20%	54	2	5
TOTAL	**100%**	**272**	**13**	**23**



SITE PLAN KEY NOTES

1. DROP OFF ZONE
2. PROPERTY LINE
3. SET BACK LINE
4. NEW STAIRS CONNECTING TO ADJACENT PROPERTY. REFER CIVIL DRAWINGS FOR DETAILS.
5. COURTYARD RECREATIONAL AREA . REFER LANDSCAPE DRAWINGS FOR DETAILS.
7. VISITORS PARKING
8. WATER BODY OR POND. REFER IANDSCAPE DRAWINGS.
9. SITOUT AREA. REFER LANDSCAPE PLAN.
10. PICKLE BALL COURT. RFFR LANDSCPE DRAWINGS FOR DETAILS.
11. NEW APPROACH WAY
12. RETAINING WALL . REFER CIVIL DRAWINGS FOR DETAILS.
14. PEDESTRIAN RAMP WITH HANDRAILS.REFER CIVIL

Goree Whitfield

24691 Del Prado Ave.
Dana Point, CA 92629
949 -234 -1950
www.goreewhitfield.com

CONSULTANTS

CIVIL
CIVWEST
695 TOWN CENTER DRIVR , SUITE 110,
COSTA MESA, CA 92626
949.610.8997 EXT.702

LANDSCAPE
RIDGE LANDSCAPE ARCHITECTS
6841 RESEARCH DR., #200, Irvine
949-387-1323 EXT.30

CONSULTANT #3 - DISCIPLINE
CONSULTANT #3 - NAME
ADDRESS
PHONE NUMBER
WEBSITE

CONSULTANT #4 - DISCIPLINE
CONSULTANT #4 - NAME
ADDRESS
PHONE NUMBER
WEBSITE

CONSULTANT #5 - DISCIPLINE
CONSULTANT #5 - NAME
ADDRESS
PHONE NUMBER
WEBSITE

CONSULTANT #6 - DISCIPLINE
CONSULTANT #6 - NAME
ADDRESS
PHONE NUMBER
WEBSITE

PROJECT NAME
CREEKSTONE SENIOR LIVING

PROJECT DESCRIPTION
SENIOR LIVING COMMUNITY (ASSISTED & INDEPENDENT LIVING AND INDEPENDENT LIVING COTTAGES) .

PROJECT ADDRESS
NW CORNER OF CHISOM TRAIL AND BOYINGTON ROAD, LOOMIS, CA 95650

OWNER INFORMATION
BPG LOOMIS, LLC.
153 CEDROS #1267
SOLANA BEACH, CA 92075

GOREE PROJECT NUMBER
2305

STAMP / SIGNATURE

ISSUE DATE
11/01/23

ISSUE HISTORY

DATE	MARK	DESCRIPTION
11/01/2023		PLANNING SUBMITTAL
01/05/2024		RESUBMITTAL PLANNING SUBMITTAL
02/02/2024		REVISED PLANNING SUBMITTAL

KEY PLAN

SHEET NAME
COMPOSITE SITE PLAN

SHEET NUMBER
A100

Source: Goree Whitfield 2/17

Transportation Impact Study for the Creekstone Senior Living Project

Figure 2 – Site Plan

Circulation System

This section addresses the first transportation bullet point on the CEQA checklist, which relates to the potential for a project to conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities.

Pedestrian Facilities

Existing and Planned Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, pedestrian signals, and curb ramps are lacking in the vicinity of the project site as sidewalks are only present on the south side of King Road for about 375 feet on the King Road overcrossing and on Boyington Road for about 1,500 feet west of Penryn Road. This is consistent with the relatively rural nature of the study area.

Pedestrian Safety

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue for pedestrians. Collision records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports were reviewed for the most current five-year period available, which was October 1, 2018, through September 30, 2023, at the time of the analysis. During the five-year study period, there were no reported collisions involving pedestrians at the study intersections.

Project Impacts on Pedestrian Facilities

Given the lack of nearby attractors as well and the type of land use which includes primarily residents who are unable to leave the site unattended for physical or mental reasons, it is reasonable to assume that the project would produce little to no pedestrian trips.

According to Section 14.44.055 of the Town of Loomis's *Municipal Code*, development projects must provide sidewalks along proposed streets and existing street frontages. As the project only proposes the construction of sidewalks on the private street serving the Independent Living cottages and not the project frontages along Boyington Road and Chisom Trail, it would conflict with Town policy and thus have a policy impact. To mitigate this impact the project should include constructing sidewalks along its frontages with Boyington Road and Chisom Trail.

Finding – Pedestrian facilities serving the project site as proposed are not consistent with Town policy requiring sidewalks along existing street frontages and would therefore have a potentially significant impact.

Recommendation – The project should include the construction of sidewalks along its frontages with Boyington Road and Chisom Trail as well as on the interior street, as proposed.

Bicycle Facilities

Existing and Planned Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2020, classifies bikeways into four categories.

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.

- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

In the project area, Class II bike lanes exist on Taylor Road from East Midas Avenue in the City of Rocklin to Taylor Road's northern terminus in the community of Newcastle, including along the entire alignment of the road through the Town of Loomis, as well as on King Road from Clayton Lane to the I-80 overcrossing. Per the *Regional Bikeway Plan 2018 Update*, County of Placer, 2018, a buffered bicycle lane is proposed on King Road from the I-80 overcrossing to Auburn Folsom Road. Likewise, a Class III bicycle route is planned for Boyington Road from King Road to the Town Limit at Chisom Trail per the *General Plan 2020-2040*, Town of Loomis, 2024.

Bicyclist Safety

Collision records for the study area were reviewed to determine if there had been any bicyclist-involved crashes. During the five-year study period between October 1, 2018, through September 30, 2023, there were no reported collisions involving a bicyclist at any of the study intersections.

Bicycle Storage

According to Section 13.36.060 of the Town's *Municipal Code*, the project would be required to provide a number of bicycle parking spaces equal to at least ten percent of the required number of parking spaces unless there is separate, secured garage parking for each dwelling unit. The 18 independent living cottage units would each have their own garage so bicycle parking would not be required for these units. The remainder of the units (64 independent living and 35 assisted living) in the main building would have a requirement to provide one vehicle parking space per two units plus one space per ten units as detailed further in the Parking Section. The 99-unit main building would therefore have an automobile parking requirement of 60 spaces, which translates to a requirement for six bicycle parking spaces. The *Municipal Code* further specifies that spaces should be distributed throughout the project, located conveniently and generally within proximity to main entrances, and be two feet wide by six feet long with seven feet of overhead clearance. The project site plan does not identify the provision of bicycle parking or storage facilities.

Project Impacts on Bicycle Facilities

Construction of the project would not conflict with the planned Class III bicycle route on Boyington Road as bicycle routes are entirely in-street and therefore are not affected by adjacent development projects.

Because the project plans do not identify bicycle parking, there may be a significant impact relative to bicycle policies adopted by the Town of Loomis. To avoid this impact, the project should identify at least six bicycle parking spaces on the project plans that satisfy the Town's requirements for size and placement.

Finding – The project would not conflict with planned off-site bicycle facilities but would need to provide at least six bicycle parking spaces designed to be consistent with the Town's bicycle policy to avoid a significant impact.

Recommendation – The project plans should be updated to include at least six bicycle parking spaces that are two feet wide, six feet long, have seven feet of overhead clearance, and are distributed throughout the project site while being located within convenient proximity to main building entrances.

Transit Facilities

Existing Transit Facilities

Placer County Transit (PCT) provides fixed route bus service in Placer County. PCT Route 50 provides loop service to destinations throughout the County with stops in the Cities of Auburn and Rocklin, and the Town of Loomis. Route 50 operates on weekdays with two-hour headways between 6:30 a.m. and 8:30 p.m., and Saturdays with two-hour headways between 8:30 a.m. and 5:15 p.m. The nearest bus stop is at Taylor Road/ King Road, approximately two-thirds of a mile west of the project site.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. PCT Paratransit is designed to serve the needs of individuals with disabilities within the Town of Loomis and the surrounding area.

Impact on Transit Facilities

As there is no existing or planned bus service within the vicinity of the project site, construction of the project would not affect adopted transit policies.

Finding – The project would be consistent with adopted policies regarding transit, resulting in a less-than-significant impact.

Roadway Facilities

Existing Roadway Facilities

There are no existing vehicle facilities on the project site. Chisom Trail has approximately 20 feet of paved width along the project's east frontage, and Boyington Road is approximately 26 feet wide along the south frontage. Per the *General Plan*, Chisom Trail is classified as a residential street serving a residential estate (RE) zone, and Boyington Road is also classified as a residential street though it does not provide direct access to any uses within the Town of Loomis other than a back entrance to Del Oro High School. A residential street that is used for RE zoning with fewer than 50 parcels is classified as a "CLASS A&B Street Section" by the *Land Development Manual*, Town of Loomis, 2004, and has a required street width of 20 to 28 feet with graded shoulders, which applies to Chisom Trail and Boyington Road within Town Limits.

Impact on Roadway Facilities

Municipal Code Section 14.44.055 requires that development projects include frontage improvements such as sidewalks, curb and gutter, and upgrading streets if deficient per the standards of the *Land Development Manual*. As Chisom Trail and Boyington Road are already of sufficient width per their classification within these standards, the project would not be required to widen these roadways. However, along with the previously discussed sidewalk, a curb and gutter would need to be provided to comply with this ordinance and should be included in the site plan to avoid a significant impact. The project as proposed would include the construction of a curb and gutter along Chisom Trail which would comply with Town policy. A curb and gutter are not proposed to be built along Boyington Road and thus would be in conflict with Town policy.

The *Land Development Manual* requires a right-turn deceleration lane for driveways if that driveway is on an arterial, more than 50 peak hour vehicles are expected to turn right into the site, there is room to provide a deceleration lane, and the travel speed of the roadway is 45 mph or greater. As both Boyington Road and Chisom Trail are residential streets (not arterials) and the project would have fewer than 50 peak hour vehicles, a right-turn deceleration lane is not required. The *Manual* prohibits right-turn acceleration lanes for driveways, and likewise specifically does not require left-turn pockets on collector or residential streets. The project as proposed does not include any of these facilities, and therefore complies with adopted policy.

The *Land Development Manual* also requires that driveways be maintained at least 150 feet from intersections. As the closest project driveway would be at least 150 feet from the intersection of Boyington Road/Chisom Trail, the project complies with this policy.

Finding – The proposed project complies with adopted policy regarding roadway facilities, except that a curb and gutter along the project frontage on Boyington Road would need to be provided per *Municipal Code* requirements to avoid a significant impact.

Recommendation – The project should include construction of curbs and gutters on Boyington Road along the project frontage.

Significance Finding – The project as proposed would not conflict with adopted transit policies and would therefore have a less-than-significant impact with regard to transit facilities. However, it would conflict with Town policies on pedestrian, bicycle, and roadway facilities. If the project design were updated to include sidewalks, curbs, and gutters along the Boyington Road frontage, and at least six bicycle parking spaces complying with Town standards were added, then there would be a less-than-significant impact on pedestrian, bicycle, and roadway facilities. Otherwise, a significant impact would result.

Vehicle Miles Traveled (VMT)

The potential for the project to conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b) was evaluated based the project's anticipated Vehicle Miles Traveled (VMT).

Significance Threshold

Guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018, as well as data produced by the Placer County VMT Estimation Tool, were used to establish the applicable VMT thresholds of significance for the proposed project.

The OPR *Technical Advisory* indicates that a residential project generating vehicle travel that is 15 or more percent below the existing townwide residential VMT per capita (or total number of miles driven per day) may indicate a less-than-significant transportation impact. This approach is consistent with the Placer County VMT Evaluation Tool. Based on the Tool, the average household VMT per resident in the Town of Loomis is 22.61 miles. The applicable significance threshold would therefore be 15 percent below this value, or 19.22 miles.

Unadjusted VMT per Capita in Project Area

The project site is in traffic analysis zone (TAZ) 1535 of the Sacramento Activity-Based Travel Simulation Model (SACSIM19). The baseline residential VMT per capita in this TAZ is 23.84 miles. This value corresponds to prevailing residential development types in the TAZ, which primarily consist of single-family residential uses. Because the proposed project would be restricted to seniors in both active and assisted living accommodations and would provide onsite amenities including dining and communal transportation that also affect the amount of VMT generated by residents, adjustments to the baseline residential VMT metrics produced by SACSIM19 for this TAZ are appropriate.

Project-Specific VMT Adjustments

The VMT per capita performance metric is comprised of the number of vehicle trips generated by a project multiplied by the average length of those trips, divided by the number of residents. Average trip lengths are typically not affected by the type of residential development (in this case, conventional versus senior housing). The number of trips generated by conventional housing as compared to senior-based housing differs substantially, however, as does the typical number of residents per unit.

The ratio of per-person trips associated with the proposed project versus the per-person trips generated at a conventional single-family home development in Loomis was used to adjust the project's estimated VMT per capita. Standard per-unit ITE trip generation rates were applied and then divided by average household occupancies to establish average per-person trip rates. ITE rates for the "Congregate Care" and "Assisted Living" land uses were applied for the project as previously discussed, and rates for "Single Family Detached Housing" (ITE LU #210) were used to represent the typical residential development type that currently exists in the project vicinity. United States Census estimates indicate that residential units in the Town of Loomis have an average occupancy of 2.37 persons per household; this value was used for the conventional single-family home per-person trip estimate. For the proposed project, the applicant estimates that the proposed mix of senior independent living units will have an average occupancy of 1.38 residents while the assisted living units will have an average occupancy of 1.14 persons.

These combined data sources were used to establish the per-person trip rates for conventional single-family housing in the project area as well as the proposed project. As summarized in Table 4, the proposed project is estimated to generate approximately 55 percent fewer daily trips per resident than are generated by existing single-family residential uses in the vicinity. This same reduction factor may be applied to the baseline VMT metrics in the project TAZ to establish a project-specific VMT per capita estimate.

Table 4 – Comparison of Per-Person Daily Trip Generation Rates			
Development Type	**Daily Trips per Unit**	**Average Unit Occupancy**	**Daily Trips per Resident**
Conventional Housing in Project Area			
Single Family Detached Housing	9.43	2.37	3.98
Proposed Project			
Congregate Care (Independent Living) – 82 units	2.21	1.38	1.60
Assisted Living – 35 units	2.60	1.14	2.28
Project Weighted Average			***1.80***
Project Compared to Conventional Housing			**-55%**

It is noted that the estimated reduction factor of 55 percent relies on average household occupancy estimates for the project that are based on the applicant's familiarity with similar facilities. If an especially conservative approach was taken in which each of the project's 117 units housed only a single resident (thereby increasing the estimated trip generation of each resident and therefore VMT per capita of the project), the reduction factor would be 41 percent.

Project VMT Analysis

Upon applying the 55 percent adjustment to reflect the lower number of trips and therefore miles traveled associated with senior housing, the project is anticipated to generate 10.73 VMT per capita, which is below the applicable significance threshold of 19.22 VMT per capita. Accordingly, the proposed project would be considered to have a less-than-significant impact on VMT. A summary of the VMT findings is shown in Table 5.

Table 5 – Vehicle Miles Traveled Analysis Summary				
Town of Loomis VMT per Capita		**Project VMT per Capita**		
Average	**Threshold**	**Unadjusted**	**Adjusted**	**Threshold Met?**
22.61	19.22	23.84	10.73	Yes

Note: VMT is measured in VMT per Capita, or the number of daily miles driven per resident; Threshold is the applicable VMT significance threshold of 15 percent below the existing Town of Loomis average; Adjusted values reflect project-specific senior housing effects on daily vehicle travel

Significance Finding – The project would be expected to have a less-than-significant impact on VMT.

Safety Issues

The potential for the project to impact safety was evaluated in terms of the adequacy of sight distance and need for turn lanes at the project accesses as well as the adequacy of stacking space in dedicated turn lanes at the study intersections to accommodate additional queuing due to adding project-generated trips and need for additional right-of-way controls. This section addresses the third transportation bullet on the CEQA checklist which is whether or not the project would substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

Site Access

The project as proposed includes four access points. Three driveways would provide access to the parking lot around the main building and would be located on Chisom Trail approximately 150 feet and 315 feet north of Boyington Road, and on Boyington Road about 340 feet west of Chisom Trail. The independent living cottages would be accessed via a private road intersecting Boyington Road approximately 540 feet west of Chisom Trail.

Sight Distance

Sight distances along Chisom Trail and Boyington Road at the three proposed driveway locations were evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. Though Caltrans does not indicate a recommended sight distance for driveways in urban areas, for safety reasons the stopping sight distance was evaluated using the approach travel speed as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway was evaluated based on the stopping sight distance criterion and approach speed on the major street.

During a field visit in May 2024, sight distances at the proposed access locations were field measured and informal speed surveys were conducted on Chisom Trail and on Boyington Road. The 85th-percentile speed measured on Chisom Trail was 19 mph in the northbound direction and 22 mph in the southbound direction. Using a design speed of 25 mph, the required stopping sight distance is 150 feet. Available sight distance of traffic both to the right (northbound) and left (southbound) is 150 feet or greater for drivers turning out of both proposed driveway locations, as well as for inbound drivers who would be turning into the site.

On Boyington Road, the westbound critical speed was measured at 43 mph and 32 mph was measured for eastbound traffic. For a design speed of 45 mph, 360 feet of stopping sight distance is required, and is available at the proposed driveway location to the left (of westbound traffic). For a design speed of 35 mph, which is also the posted speed on Boyington Road, a stopping sight distance of 250 feet is required. For a driver leaving the Boyington Road driveway, only 115 feet of sight distance to the right (of eastbound traffic) is available due to the dense vegetation on the inside of the horizontal curve on Boyington Road between the proposed driveway and proposed cul-de-sac. Likewise, only 200 feet of sight distance to an eastbound driver turning left into the project site is available, short of the 250 feet required for 35-mph travel. Clearing out this vegetation would increase sight lines, potentially to the required 250 feet for right-turns out and left-turns into the Boyington Road driveway.

As the private road serving the independent cottages would be classified as a roadway, not a driveway, its connection to Boyington Road would therefore be considered an intersection for which corner sight distance criteria apply. Given the location of the proposed intersection between two horizontal curves on Boyington Road, the posted speed limit of 35 mph was used as the design speed limit. For the intersection of a public road and private road with a 35-mph design speed, corner sight distances of 385 feet to the left and 335 to the right are required. A stopping sight distance of 250 feet for inbound left-turn drivers is also required. During the field visit, 350 feet to the right was observed, as was 380 feet for an inbound left-turning driver, satisfying their respective requirements. However, only 100 feet to the left of the driveway was observed due to the dense vegetation on the inside of the horizontal curve on Boyington Road. Clearing this vegetation would increase sight lines, potentially to provide adequate visibility.

Table 6 summarizes the minimum sight distance requirements and measured sight distance for each project access point, as well as if the measured sight distance is adequate.

Table 6 – Intersection Sight Distance Criteria

Access Point Location Movement (Applied Sight Distance Requirement)	**Minimum Required Sight Distance (feet)**	**Measured Sight Distance (feet)**	**Adequate?**
Chisom Trl 150 feet North of Boyington Rd			
To Left (25 mph SSD)	150	150	Yes
To Right (25 mph SSD)	150	150	Yes
Left Turn in (25 mph SSD)	150	150	Yes
Chisom Trl 315 feet North of Boyington Rd			
To Left (25 mph SSD)	150	300	Yes
To Right (25 mph SSD)	150	200	Yes
Left Turn In (25 mph SSD)	150	300	Yes
Boyington Rd 340 feet West of Chisom Trl			
To Left (45 mph SSD)	360	400	Yes
To Right (35 mph SSD)	250	**115**	**No**
Left Turn In (35 mph SSD)	250	**200**	**No**
Boyington Rd 540 feet West of Chisom Trl			
To Left (35 mph CSD)	385	**100**	**No**
To Right (35 mph CSD)	335	350	Yes
Left Turn In (35 mph SSD)	250	380	Yes

Note: mph = miles per hour; SSD = stopping sight distance; CSD = corner sight distance
Source: *Highway Design* Manual, 7th Edition, California Department of Transportation, 2019

Finding – The right-turn out and left-turn in movements at the proposed driveway on Boyington Road 340 feet west of Chisom Trail would have inadequate sight distances due to the dense vegetation on the inside corner of the curve on Boyington Road. Likewise, the left-turn out sight distance for the private road connection to Boyington Road 540 feet west of Chisom Trail would be inadequate due to this vegetation.

Recommendation – The vegetation on the inside corner of Boyington Road between the proposed driveway and private street should be cleared such that sufficient sight distances are achieved in all directions.

Access Analysis

While the Town's *Land Development Manual* specifically does not require left-turn lanes on residential streets including Boyington Road and Chisom Trail, to assess potential safety issues the need for a left-turn lane into the project site was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method For Prioritizing Intersection Improvements*, 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes to determine the need for a left-turn pocket based on safety issues.

To achieve the most conservative analysis, the intersection of Boyington Road/Chisom Trail was chosen as the starting point for this evaluation as it would represent the greatest volumes on either street and therefore the most likely location where a turn lane would be warranted. Likewise, Future volumes were used and all project trips were assumed to be turning at this intersection rather than being distributed among the four project access

points (three driveways and one private street). With all of these conservative assumptions combined, a left-turn lane would not be warranted for either the a.m. or p.m. peak hour. It can therefore be concluded by inspection that a left-turn lane would also not be warranted at any of the four proposed access points as each would have lower volumes than Boyington Road/Chisom Trail under this hypothetical maximum demand situation.

The left-turn lane warrant worksheets are included in Appendix B.

Finding – The installation of a left-turn lane at Boyington Road/Chisom Trail or at any of the four project access points would not be warranted under any volume scenario evaluated.

Queuing

The Town of Loomis does not prescribe thresholds of significance regarding queue lengths. However, an increase in queue length due to project traffic was considered a potentially significant impact if the increase would cause the queue to extend out of a dedicated turn lane into a through traffic lane, the back of queue into a visually restricted area such as a blind corner, or down a freeway off-ramp into the deceleration area from the freeway mainline. This is defined as the first 300 feet from the start of gore as that is the stopping sight distance for a vehicle traveling at 40 mph, which is the advisory speed limit for both off-ramps in the study area. If queues would already be expected to extend past a dedicated turn lane, or into a visually restricted area without project traffic, or into an off-ramp deceleration area or freeway mainline, the addition of project traffic was considered to constitute a potentially significant impact only if it would cause a new unacceptable condition; in other words, if the queue were already beyond the turn lane and the project would cause it to stack into an adjacent intersection or a visually restricted area, and that would not occur without the project, that would be considered an impact.

Under each scenario, the projected maximum queues at the study intersections were determined using the SIMTRAFFIC application of Synchro and averaging the 95th percentile projected queue for each of ten runs. Summarized in Table 7 are the predicted queue lengths for approaches to intersections where there is a turn lane or freeway off-ramp. Copies of the SIMTRAFFIC projections are contained in Appendix C.

Table 7 – Maximum Queues

Study Intersection Approach		Available Storage	Maximum Queues							
			AM Peak Hour				PM Peak Hour			
			E	E+P	F	F+P	E	E+P	F	F+P
3.	Penryn Rd/I-80 W Ramps-Boyington Rd									
	Westbound Off-Ramp[1]	490	215	209	184	190	123	125	115	117
	Northbound Left-Turn	100	**123**	**123**	**116**	**115**	**115**	**115**	**107**	**108**
	Northbound Right-Turn	40	**85**	**82**	**80**	**82**	**82**	**82**	**81**	**82**
	Southbound Left-Turn	420	257	245	324	323	167	164	219	261
	Southbound Right-Turn	80	57	64	58	53	54	51	50	54
4.	Penryn Rd/I-80 E Ramps-Boulder Creek Rd									
	Eastbound Off-Ramp[1]	450	153	160	227	254	171	176	203	201
	Northbound Left-Turn	80	25	23	33	37	24	26	29	30
	Southbound Left-Turn	70	17	13	16	15	13	14	15	11

Note: Maximum Queue based on the average of the 95th percentile value from ten SIMTRAFFIC runs; all distances are measured in feet; E = existing conditions; E+P = existing plus project conditions; F = future conditions; F+P = future plus project conditions; **Bold** text = queue length exceeds available storage

[1]Off-ramp length calculated by subtracting stopping sight distance for 40 mph (300 feet) from the ramp length, as measured from stop bar to start of gore.

At Penryn Road/I-80 West Ramps-Boyington Road, queues exceed or would exceed stacking capacity under all scenarios assessed for the northbound left-turn and right-turn lanes. The addition of project traffic would nominally affect these queues by at most a few feet added or subtracted. None of the other queues assessed would extend into another intersection or a visual restricted space without or with project traffic added; therefore, the project would not introduce new safety impacts as compared to conditions without the project.

The queues for several movements are predicted to decrease slightly with project traffic added compared to without-project conditions. This is attributed to the stochastic nature of the modeling wherein traffic is randomly seeded and the average of ten runs is reported, occasionally resulting in shorter queues with project traffic than without it. However, as these reductions are at most 12 feet, the practical effect of the project would be negligible.

Finding – The project does not cause any queues to exceed available storage that would be contained within the stacking capacity without the project, and where there are increases to already deficient locations, the increase would be two feet or fewer so the back-of-queue would not extend into a visually restrictive or other sensitive area.

Significance Finding – The vegetation present on the north side of Boyington Road between the two proposed driveways on this street would restrict sight distance for several movements at these driveways, presenting a potentially significant impact.

Recommendation – Vegetation should be cleared out to open sight lines such that adequate sight distance is achieved.

Significance After Mitigation – The recommended clearing would reduce this impact to less than significant.

Emergency Access

The final transportation bullet on the CEQA checklist requires an evaluation as to whether the project would result in inadequate emergency access or not.

With drivable street widths of at least 24 feet on the proposed private street and the project as proposed complying with Town roadway standards, the project is assumed to not create any hazards or obstacles for emergency services. Since all roadway users must yield the right-of-way to emergency vehicles when using their sirens and lights, the added project-generated traffic is expected to have a less-than-significant impact on emergency response. Assuming the project will be designed or improved to meet the applicable fire codes, it would therefore have a less-than-significant impact on emergency response.

Significance Finding – The proposed project would need to be designed to accommodate emergency response vehicles and would not impede emergency responders, resulting in a less-than-significant impact on emergency response.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), *Sixth Edition,* Transportation Research Board, 2017. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for the intersections with side street stop controls, or those which are unsignalized and have one or two approaches stop controlled, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The study intersection that is currently controlled by a traffic signal (Penryn Road/I-80 West Ramps-Boyington Road) was evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using signal timing obtained from Caltrans and optimized timing was assumed for the Future scenarios.

Table 8 lists the delays and associated LOS based on type of intersection control.

Table 8 – Intersection Level of Service Criteria

LOS	Two-Way Stop-Controlled	Signalized
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2017

Traffic Operation Standards

Per the *General Plan 2020*-2040, 2024, the Town of Loomis maintains an LOS C or better standard for both study intersections within Town limits: King Road/Boyington Road and Boyington Road/Chisom Trail. The County of Placer also maintains an LOS C standard for roadways within a half-mile of a state highway per the *Countywide General Plan Policy Document*, County of Placer, 2013. This standard applies to the intersections of Penryn Road/I-80 West Ramps-Boyington Road and Penryn Road/I-80 East Ramps-Boulder Creek Road.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected in May 2024 while local schools were in session.

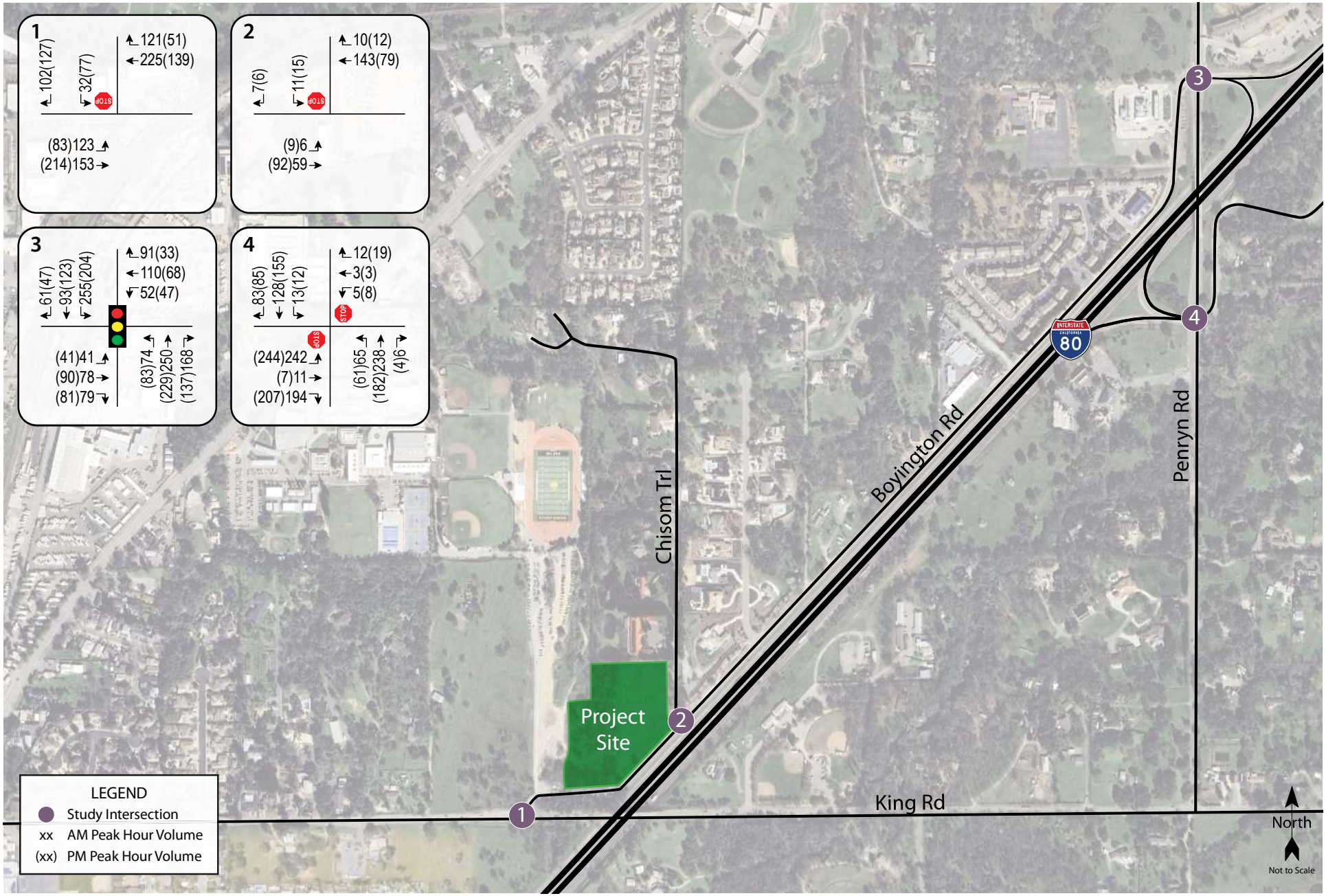
Under existing volumes, the three Boyington Road intersections are operating acceptably during the a.m. and p.m. peak hour while Penryn Road/I-80 West Ramps-Boulder Creek Road has unacceptable LOS E operation on the eastbound (off-ramp) approach. As this approach represents approximately 45 percent of all entering traffic during the a.m. peak hour (more than any other individual approach), this operation affects an appreciable proportion of intersection traffic. A summary of the intersection Level of Service calculations is contained in Table 9, and copies of the calculations are provided in Appendix D. The existing traffic volumes are shown in Figure 3.

Table 9 – Existing Peak Hour Intersection Levels of Service

	Study Intersection ***Approach***	**AM Peak**		**PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**
1.	King Rd/Boyington Rd	3.7	A	4.7	A
	Southbound (Boyington Rd) Approach	*12.9*	*B*	*12.6*	*B*
2.	Boyington Rd/Chisom Trl	0.9	A	1.3	A
	Southbound (Chisom Trl) Approach	*9.8*	*A*	*9.6*	*A*
3.	Penryn Rd/I-80 W Ramps-Boyington Rd	33.9	C	24.4	C
4.	Penryn Rd/I-80 E Ramps-Boulder Creek Rd	17.7	C	12.4	B
	Eastbound (I-80 E Ramps) Approach	***37.6***	***E***	*24.6*	*C*
	Westbound (Boulder Creek Rd) Approach	*14.4*	*B*	*13.3*	*B*
	With All-Way Stop Control	15.2	C	13.8	B
	With Yield Control (Roundabout)	7.2	A	6.8	A

Note: Delay is measured in average seconds per vehicle; LOS = Level of Service; SB = Southbound; EB = Eastbound; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with potential improvements

To improve operation at Penryn Road/I-80 West Ramps-Boulder Creek Road to LOS C or better (the County's adopted standard for acceptable operation), the County may wish to install stop controls on the two Penryn Road approaches such that the intersection would become all-way stop controlled and achieve LOS C operation during the a.m. peak hour. If a roundabout were to be constructed instead, it would operate at LOS A during both peak hours. It is noted that because this intersection is under the jurisdiction of Caltrans an Intersection Control Evaluation (ICE) would need to be completed to justify any change in controls.



lms001.ai 7/24

Transportation Impact Study for the Creekstone Senior Living Project

Figure 3 – Existing Traffic Volumes

Future Conditions

Year 2040 intersection turning movements were developed using the Furness procedure, which is a commonly accepted factoring algorithm used within the traffic engineering field wherein the base year turning movement counts at the intersection are factored until the total volumes in and out of each leg closely match the adjusted link volumes based on the base year and future scenario volumes from the Sacramento Activity-Based Travel Simulation Model (SACSIM19). A computer application of the Furness procedure was used to produce the future intersection turning movement volumes.

According to the *General Plan*, Boyington Road will be extended to Horseshoe Bar Road. The model has a link for this extension under the Future scenario, but no volumes assigned. Therefore, this extension was excluded from the Future Conditions scenario and existing geometry and controls at King Road/Boyington Road were retained. Optimized timing for the signal at Penryn Road/I-80 West Ramps-Boyington Road was assumed for Future conditions.

Under the anticipated Future volumes, the study intersections are expected to operate similarly to Existing volumes, with continued unacceptable operations at Penryn Road/I-80 West Ramps-Boulder Creek Road during the a.m. peak hour for the off-ramp approach. Operating conditions are summarized in Table 10 and Future volumes are shown in Figure 4.

Table 10 – Future Peak Hour Intersection Levels of Service

	Study Intersection ***Approach***	**AM Peak**		**PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**
1.	King Rd/Boyington Rd	3.2	A	4.1	A
	Southbound (Boyington Rd) Approach	*13.2*	*B*	*12.5*	*B*
2.	Boyington Rd/Chisom Trl	1.3	A	1.4	A
	Southbound (Chisom Trl) Approach	*9.6*	*A*	*9.6*	*A*
3.	Penryn Rd/I-80 W Ramps-Boyington Rd	30.7	C	29.0	C
4.	Penryn Rd/I-80 E Ramps-Boulder Creek Rd	14.6	B	11.3	B
	Eastbound (I-80 E Ramps) Approach	***31.5***	***D***	*22.4*	*C*
	Westbound (Boulder Creek Rd) Approach	*14.0*	*B*	*12.9*	*B*
	With All-Way Stop Control	13.1	B	13.0	B
	With Yield Control (Roundabout)	6.6	A	6.4	A

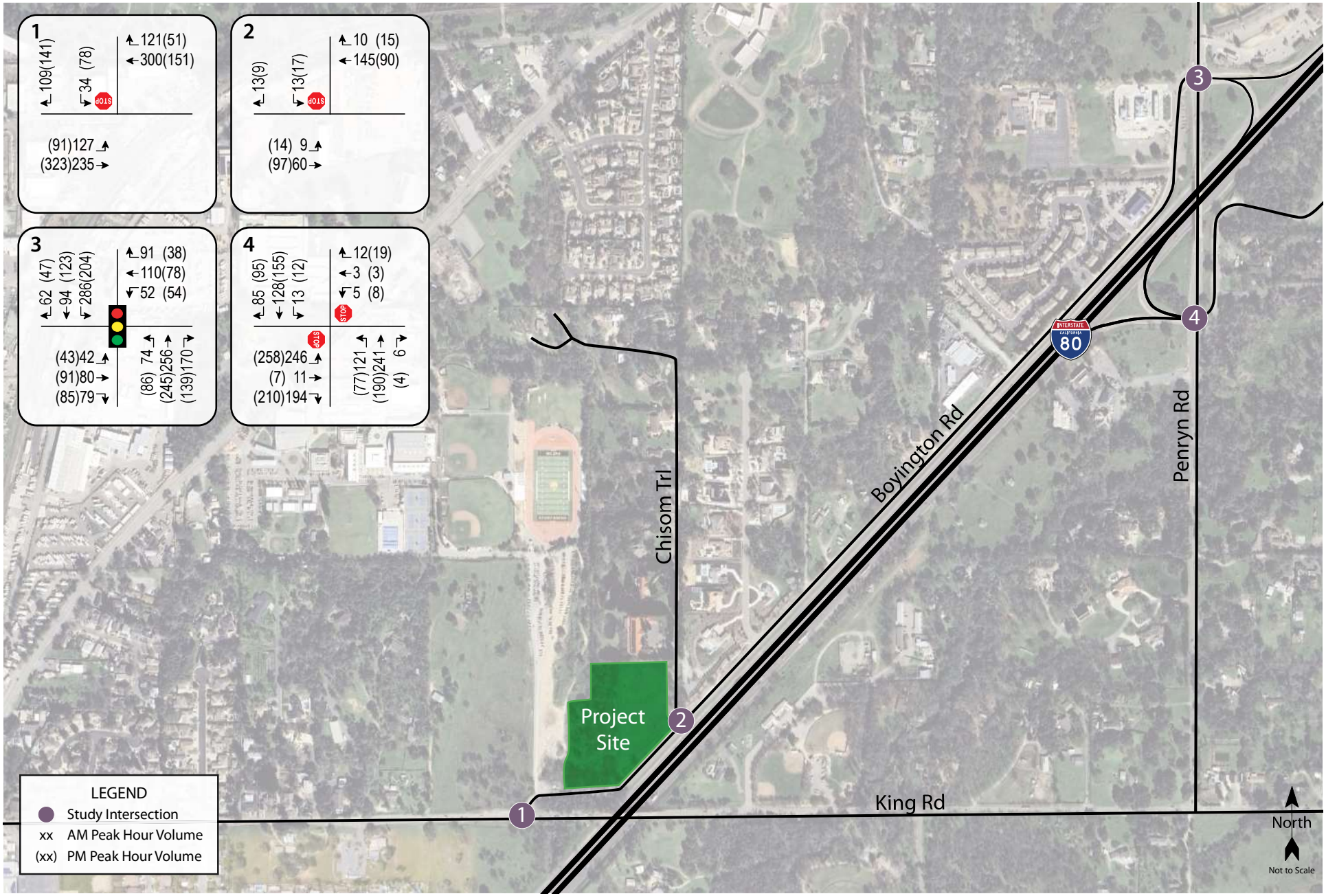
Note: Delay is measured in average seconds per vehicle; LOS = Level of Service; SB = Southbound; EB = Eastbound; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with potential improvements

The intersection would operate at LOS B during both peak hours if all-way stop control was installed, and LOS A during both peak hours with construction of a roundabout.

Project Conditions

Existing plus Project Conditions

Upon the addition of project-related traffic to existing volumes the study intersections would be expected to operate at the same Levels of Service as without the project. These results are summarized in Table 11. Figure 5 shows the project traffic volumes as assigned to each study intersection by combining the estimated trip generation and trip distribution, and existing volumes with project traffic added are shown in Figure 6.

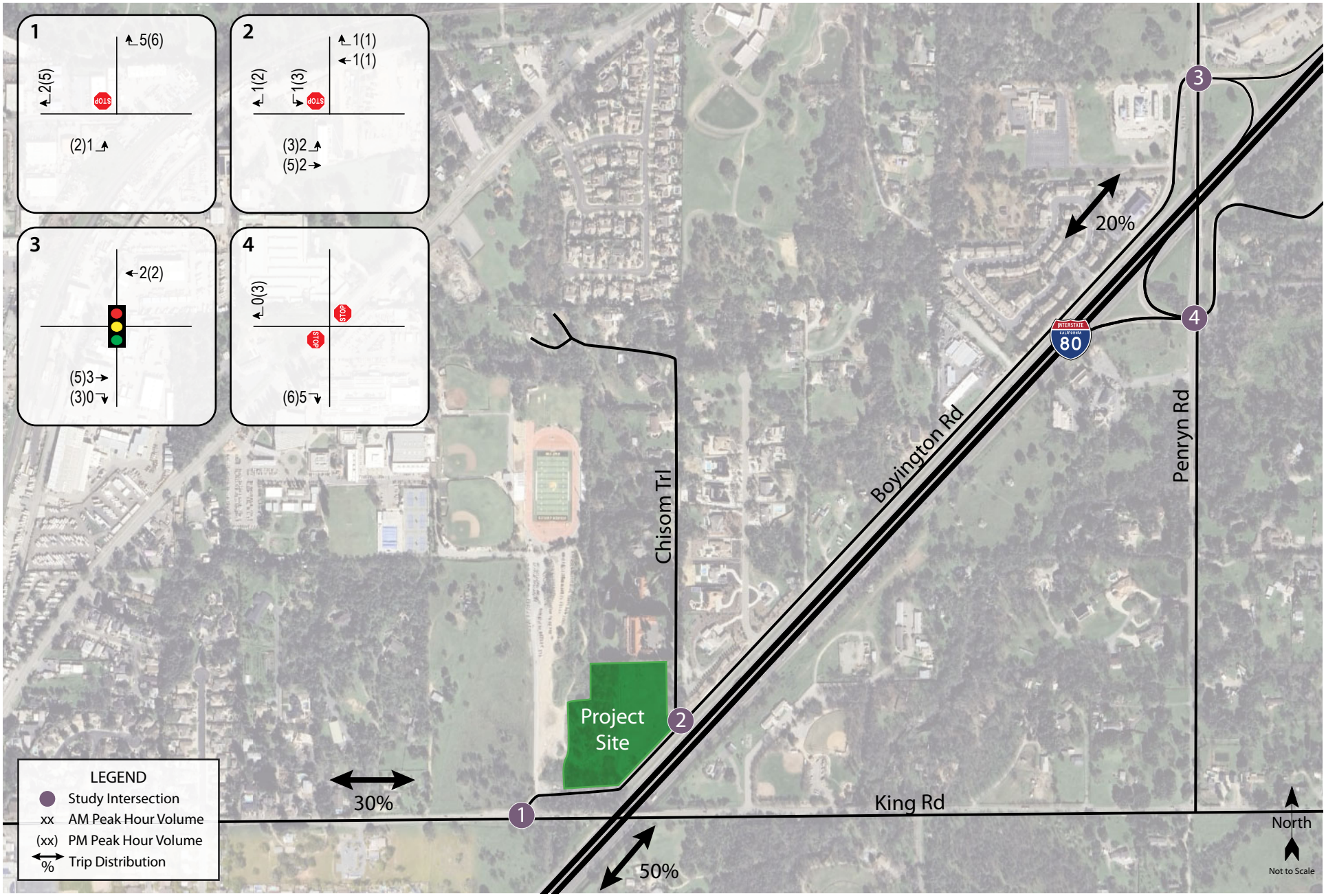


lms001.ai 7/24

Transportation Impact Study for the Creekstone Senior Living Project

Figure 4 – Future Traffic Volumes

W-Trans



lms001.ai 2/25

Transportation Impact Study for the Creekstone Senior Living Project

Figure 5 – Project Traffic Volumes and Trip Distribution

W-Trans

lms001.ai 2/25

Transportation Impact Study for the Creekstone Senior Living Project

Figure 6 – Existing plus Project Traffic Volumes

Table 11 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

	Study Intersection *Approach*	Existing Conditions				Existing plus Project			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1.	King Rd/Boyington Rd	3.7	A	4.7	A	3.7	A	4.7	A
	SB (Boyington Rd) Approach	*12.9*	*B*	*12.6*	*B*	*13.0*	*B*	*12.6*	*B*
2.	Boyington Rd/Chisom Trl	0.9	A	1.3	A	1.1	A	1.5	A
	SB (Chisom Trl) Approach	*9.8*	*A*	*9.6*	*A*	*9.9*	*A*	*9.7*	*A*
3.	Penryn Rd/I-80 W Ramps-Boyington Rd	33.9	C	24.4	C	34.3	C	24.8	C
4.	Penryn Rd/I-80 E Ramps-Boulder Creek Rd	17.7	C	12.4	B	17.7	C	12.6	B
	EB (I-80 E Ramps) Approach	***37.6***	***E***	*24.6*	*C*	***37.3***	***E***	*24.8*	*C*
	WB (Boulder Creek Rd) Approach	*14.4*	*B*	*13.3*	*B*	*14.4*	*B*	*13.4*	*B*
	With All-Way Stop Control	15.2	C	13.8	B	15.2	C	13.9	B
	With Yield Control (Roundabout)	7.2	A	6.8	A	7.3	A	6.9	A

Note: Delay is measured in average seconds per vehicle; LOS = Level of Service; SB = Southbound; EB = Eastbound; WB = Westbound; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with potential improvements

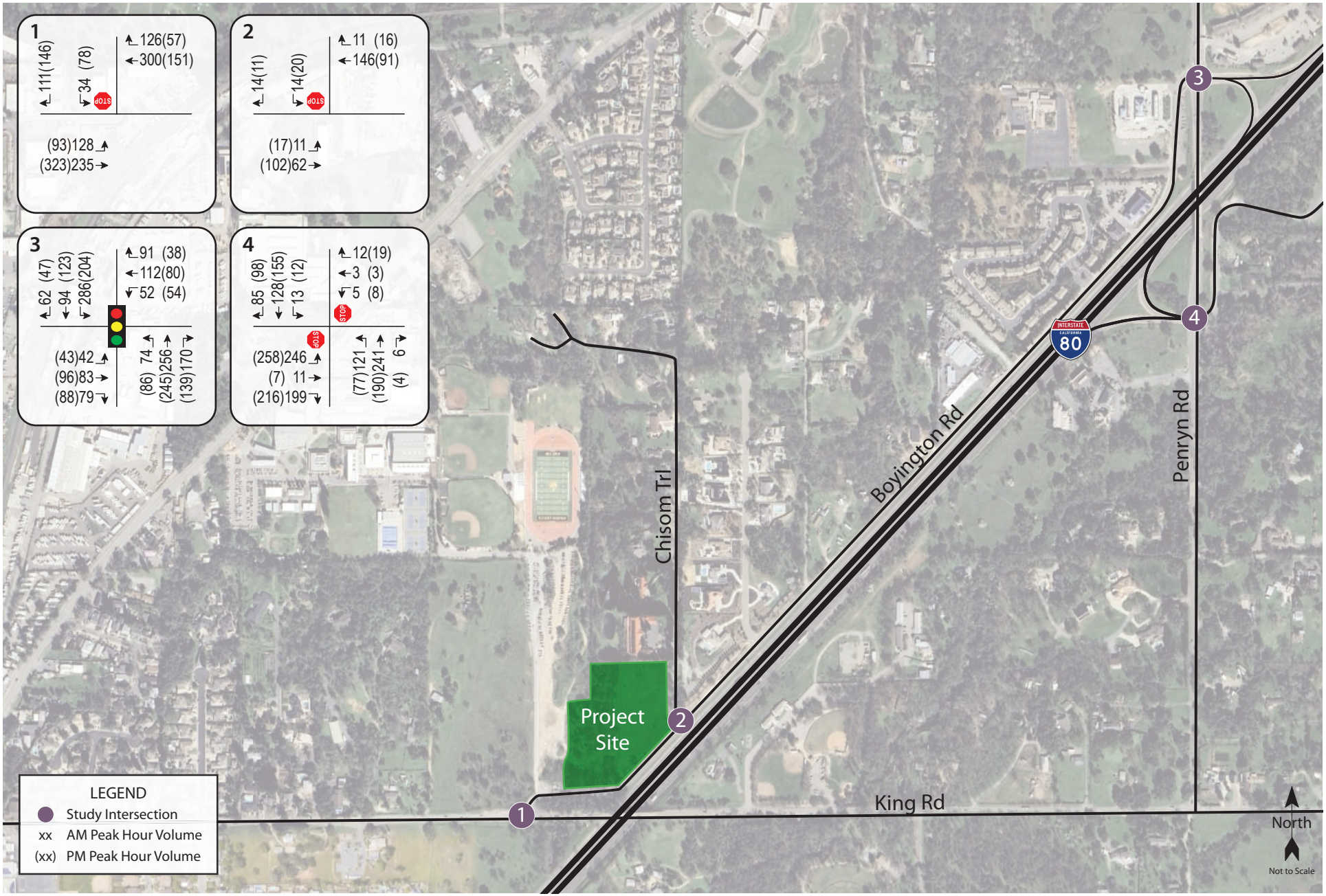
The deficient LOS E operation for off-ramp traffic at Penryn Road/I-80 West Ramps-Boulder Creek Road would improve slightly with project traffic during the a.m. peak hour, from an average of 37.6 to 37.3 seconds of delay per vehicle. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are currently underutilized or have delays that are below the intersection or approach average, resulting in a better balance between movements and lower overall average delay. For the eastbound (off-ramp) approach, the project adds traffic predominantly to the right-turn movement, which has an average delay that is lower than for left-turning traffic, lowering the average for the approach as a whole. The conclusion could incorrectly be drawn that the project actually improves operation based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in conditions as a result of the project.

It is noted that while the project would not adversely affect operations at any of the study intersections, if the County did pursue installation of all-way stop control or a roundabout at Penryn Road/I-80 West Ramps-Boulder Creek Road, then operations would be improved to LOS B or C with all-way stop control and LOS A with a roundabout. This would not be a project improvement; operational results for Existing plus Project volumes are provided for informational purposes only.

Finding – The study intersections would be expected to continue operating at the same service levels upon the addition of project-generated traffic. Delay at Penryn Road/I-80 West Ramps-Boulder Creek Road, which is operating deficiently under Existing (no project) volumes, would not be materially affected by the addition of project traffic.

Future plus Project Conditions

The study intersections would operate at the same Levels of Service with the addition of project traffic to future volumes as without it. The Future plus Project traffic volumes are shown in Figure 7 and Future plus Project operating conditions are summarized in Table 12.



lms001.ai 2/25

Transportation Impact Study for the Creekstone Senior Living Project

Figure 7 – Future plus Project Traffic Volumes

Table 12 – Future and Future plus Project Peak Hour Intersection Levels of Service

	Study Intersection *Approach*	Future Conditions				Future plus Project			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1.	King Rd/Boyington Rd	3.2	A	4.1	A	3.2	A	4.2	A
	SB (Boyington Rd) Approach	*13.2*	*B*	*12.5*	*B*	*13.2*	*B*	*12.4*	*A*
2.	Boyington Rd/Chisom Trl	1.3	A	1.4	A	1.4	A	1.7	A
	SB (Chisom Trl) Approach	*9.6*	*A*	*9.6*	*A*	*9.7*	*A*	*9.7*	*A*
3.	Penryn Rd/I-80 W Ramps-Boyington Rd	30.7	C	29.0	C	31.1	C	31.1	C
4.	Penryn Rd/I-80 E Ramps-Boulder Creek Rd	14.6	B	11.3	B	14.6	B	11.3	B
	EB (I-80 E Ramps) Approach	***31.5***	***D***	*22.4*	*C*	***31.3***	***D***	*22.4*	*C*
	WB (Boulder Creek Rd) Approach	*14.0*	*B*	*12.9*	*B*	*14.0*	*B*	*12.9*	*B*
	With All-Way Stop Control	13.1	B	13.0	B	13.1	B	13.0	B
	With Yield Control (Roundabout)	6.6	A	6.4	A	6.6	A	6.5	A

Note: Delay is measured in average seconds per vehicle; LOS = Level of Service; SB = Southbound; EB = Eastbound; WB = Westbound; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with potential improvements

Similar to with Existing plus Project conditions, the addition of project traffic would slightly improve operation for the one deficient movement, which is the eastbound (off-ramp) approach to Penryn Road/I-80 West Ramps-Boulder Creek Road during the a.m. peak hour. This is the result of the project adding right-turn movements to this approach, which would have a lower delay than the left-turn movements, lowering the average delay of the whole approach even though in reality, there would be an imperceptible difference to delays as a result of project traffic. The project therefore would not adversely affect intersection operations in the study area.

Finding – The addition of project traffic to future volumes would not create new or otherwise worsen preexisting deficient conditions, resulting in an acceptable effect on traffic operation.

Parking

The project was analyzed to determine whether the proposed parking supply would satisfy local requirements for parking provision, or would be sufficient for the anticipated parking demand. The project site as proposed would provide a total of 61 parking spaces in a lot wrapping around the main building, three of which would be accessible and 13 of which would be covered. The 18 independent living cottages would have one garage and one driveway space each for a total of 36 spaces, as well as four communal visitor spaces. In total, 101 parking spaces would be provided including 31 covered spaces.

Jurisdiction parking supply requirements are based on the Town of Loomis *Municipal Code*. The Town has indicated that the project would be categorized as a "Senior housing project," for which Section 13.36.040 of the *Municipal Code* requires one parking space per two units with half of these spaces covered, plus an additional guest parking space per ten units. Applied to the total unit count of 117 senior housing units, this results in a requirement for 58.5 parking spaces plus 11.7 guest parking spaces, for a total parking space requirement of 71 stalls. For covered parking, half of the required 58.5 non-guest parking spaces translates to the need for 30 covered parking spaces. Therefore, the 101 total parking spaces proposed for the project, including 31 covered parking spaces, would be sufficient to meet the *Municipal Code* requirements.

The proposed parking supply and Town requirements are shown in Table 13.

Table 13 – Parking Analysis Summary

Land Use	**Units**	**Supply (spaces)**		**City Requirements (spaces)**		
Parking Component		**Total**	**Covered**	**Rate**	**Total**	**Covered**
Senior Housing Project	117 du	101	31			
General Spaces				1.0 per 2 du with half covered	58.5	30
Guest Spaces				1.0 per 10 du	11.7	-
Total		**101**	**31**		**71**	**30**

Note: du = dwelling unit

Section 13.36.040.D. of the *Municipal Code* prescribes that parking supplied in excess of the number required shall only be allowed with a minor use permit and with additional landscaping and pedestrian amenities provided to the satisfaction of the Town. The applicant therefore should pursue approval of a minor use permit for an excessive parking supply and approval of the project's landscaping and pedestrian amenities.

Section 13.36.070 requires one motorcycle space to be provided for every 50 automobile spaces or fraction thereof. Two motorcycle spaces would therefore be required for the proposed parking area, matching the two delineated on the site plan. The *Municipal Code* further requires that motorcycle spaces be at least four feet by seven feet, located near the main entrance of a structure, and accessible via the same aisles used to access the automobile spaces. The site plan indicates that these requirements would be met.

The *Americans with Disabilities Act Accessibility Standards, Section 208 Parking Spaces*, US Access Board, specifies that different public parking facilities shall have their accessible space requirements calculated separately. For the proposed project, there are two distinct public parking facilities defined as serving different uses and separated by terrain, sidewalks, or other features impassable to motor vehicles: the 61-space parking lot serving the main building, and the four visitor spaces serving the independent living cottages. For the 61-space lot, three accessible spaces must be provided, of which at least one must be van accessible. Based on the provided site plan, this requirement is met. However, the four spaces for visitors at the cottages does not include any accessible spaces, whereas at least one van-accessible space would be required and should be included in an updated site plan.

Finding – The proposed parking supply would be sufficient to meet or exceed Town requirements, including for covered and motorcycle parking. The three accessible spaces, including one van-accessible space, for the parking lot serving the main building would satisfy accessibility requirements. However, a van-accessible space would required for the visitor parking for the independent living cottages.

Recommendation – The applicant should apply for a minor use permit for providing parking in excess of the amount required, in addition to securing Town approval of landscaping and pedestrian amenities. The independent living cottages' visitor parking should be updated to include at least one van-accessible parking space.

Conclusions and Recommendations

Conclusions

- The project would have an anticipated trip generation averaging 272 daily trips, including 13 and 23 trips during the a.m. and p.m. peak hours respectively.

- As proposed, the project would conflict with adopted policies regarding pedestrian, bicycle, and roadway facilities, presenting a potentially significant impact. Adjustments to the site plan would reduce these impacts to less than significant. The project would have a less-than-significant impact on adopted policies for transit facilities.

- The project would be expected to have a less-than-significant impact on VMT as it would generate less than half of the average VMT per capita of the Town of Loomis as a whole.

- With respect to safety, the project would have a potentially significant impact due to the dense vegetation on the site frontage along Boyington Road restricting sight lines for the two proposed access points on Boyington Road. Clearing out this vegetation to increase sight distance to adequate levels would reduce this impact to less than significant. Otherwise, the project would not significantly impact intersection vehicle queue lengths or require the installation of a left-turn lane into the project site or at Boyington Road/Chisom Trail.

- The project as proposed would have a less-than-significant impact on emergency response.

- The three study intersections on Boyington Road would operate acceptably without or with the addition of project traffic under existing and future volumes. Penryn Road/I-80 West Ramps-Boulder Creek currently has and would continue to have deficient delays for eastbound (off-ramp) traffic under all scenarios assessed, though the addition of project traffic would not worsen this delay and therefore would not have an adverse effect. Replacement of the existing two-way stop control with all-way stop control or a roundabout would improve operations to an acceptable level, though this is noted for information purposes only as this improvement would not be need due to the project.

- The proposed parking supply for the project would be sufficient per the *Municipal Code*, although a minor use permit and Town approval of pedestrian and landscaping amenities would need to be secured as the proposed parking supply exceeds the Town requirement. ADA requirements prescribe that distinct parking facilities should have separate accessible parking stalls. As proposed, the site plan does not show accessible parking in the independent living cottages' visitor parking area.

Recommendations

- The project design should be updated to include sidewalks, curbs, and gutters along the site frontage on Boyington Road, sidewalks along the Chisom Trail frontage, and at least six bicycle parking spaces that satisfy the Town's requirements for placement and design.

- The vegetation on the north side (inside corner) of Boyington Road between the proposed project driveway and private street should be cleared out to increase sight lines to acceptable distances.

- The applicant should apply for a minor use permit for the provision of parking spaces in excess of the total required, as well as securing approval from the Town for the project's pedestrian and landscaping features.

- The site plan should be updated to include a van-accessible parking space as part of the visitor parking for the independent living cottages.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE (Civil, Traffic), PTOE
Traffic Engineer	Kevin Carstens, PE (Civil, Traffic)
Associate Engineer	William Andrews, PE (Traffic)
Assistant Engineer	Valerie Haines, EIT
Graphics	Jessica Bender
Editing/Formatting	Jessica Bender, Rebecca Mansour
Quality Control	Dalene J. Whitlock, PE (Civil, Traffic), PTOE

References

2021 Collision Data on California State Highways, California Department of Transportation, 2023

Americans with Disabilities Act Accessibility Standards, Section 208 Parking Spaces, US Access Board, 2010

California Vehicle Code, State of California, 2024, http://leginfo.legislature.ca.gov/faces/codesTOCSelected.xhtml?tocCode=VEH&tocTitle=+Vehicle+Code+-+VEH

General Plan 2020-2040, Town of Loomis, 2024

Highway Capacity Manual, 6th Edition, Transportation Research Board, 2017

Highway Design Manual, 7th Edition, California Department of Transportation, 2020

Intersection Channelization Design Guide, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985

Land Development Manual, Town of Loomis, 2004

Method for Prioritizing Intersection Improvements, Washington State Transportation Center, 1997

Municipal Code, Town of Loomis, 2024

Parking Generation, 5th Edition, Institute of Transportation Engineers, 2019

Persons per household, 2018-2022, United States Census, 2023

Placer County Transit, https://placercountytransit.com/

Regional Bikeway Plan 2018 Update, County of Placer, 2018

Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2018-2023

Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory, California Governor's Office of Planning and Research, 2018

Trip Generation Manual, 11th Edition, Institute of Transportation Engineers, 2021

LMS001

Appendix A

Collision Rate Calculations

This page intentionally left blank

Intersection Collision Rate Worksheet

Creekstone Senior Living Community Project TIS

Intersection # 1: King Road & Boyington Road
Date of Count: Tuesday, April 30, 2024

Number of Collisions: 1
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 5700
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{1 \times 1{,}000{,}000}{5{,}700 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.10 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.13 c/mve**	**1.3%**	**47.3%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Intersection # 2: Chisom Trail & Boyington Road
Date of Count: Tuesday, April 30, 2024

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 1600
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Tee
Control Type: No Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{0 \times 1{,}000{,}000}{1{,}600 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.00 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.08 c/mve**	**1.7%**	**43.4%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Creekstone Senior Living Community Project TIS

Intersection # 3: Penryn Road & WB US-80-Boyington Road
Date of Count: Tuesday, April 30, 2024

Number of Collisions: 10
Number of Injuries: 5
Number of Fatalities: 0
Average Daily Traffic (ADT): 10200
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Suburban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{10 \times 1{,}000{,}000}{10{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.54 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.55 c/mve**	**0.5%**	**39.2%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Intersection # 4: Penryn Road & EB US-80-Boulder Creek Road
Date of Count: Tuesday, April 30, 2024

Number of Collisions: 13
Number of Injuries: 6
Number of Fatalities: 0
Average Daily Traffic (ADT): 9200
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Suburban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{13 \times 1{,}000{,}000}{9{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.77 c/mve**	**0.0%**	**46.2%**
Statewide Average*	**0.36 c/mve**	**1.5%**	**42.6%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Appendix B

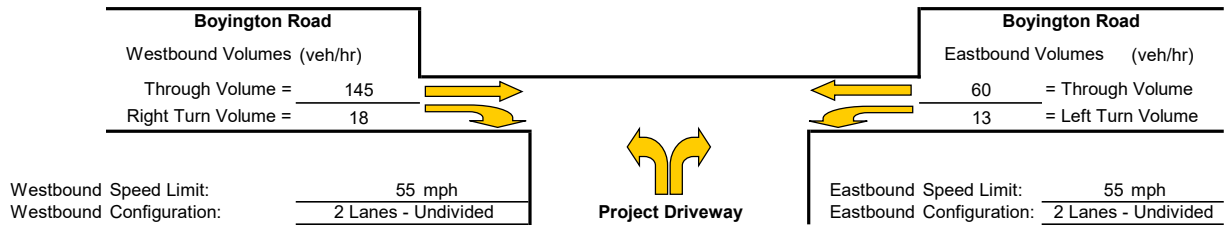
Turn Lane Warrant Worksheets

This page intentionally left blank

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Boyington Road/Chisom Trail with 100% of Project Volumes
Study Scenario: AM Future plus Project

Direction of Analysis Street: East/West
Cross Street Intersects: From the North



Westbound Speed Limit: 55 mph
Westbound Configuration: 2 Lanes - Undivided

Eastbound Speed Limit: 55 mph
Eastbound Configuration: 2 Lanes - Undivided

Westbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	163
If AV<Va then warrant is met		-

Right Turn Lane Warranted: **NO**

Westbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	163
If AV<Va then warrant is met		-

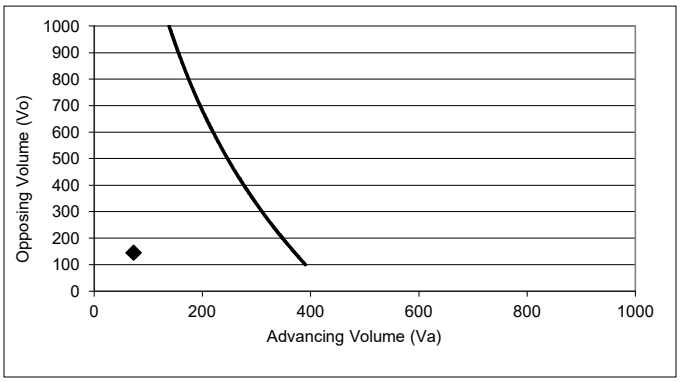
Right Turn Taper Warranted: **NO**

Eastbound Left Turn Lane Warrants

Percentage Left Turns %lt 17.8 %

Advancing Volume Threshold AV 371 veh/hr

If AV<Va then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 55 mph

Turn lane warranted if point falls to right of warrant threshold line

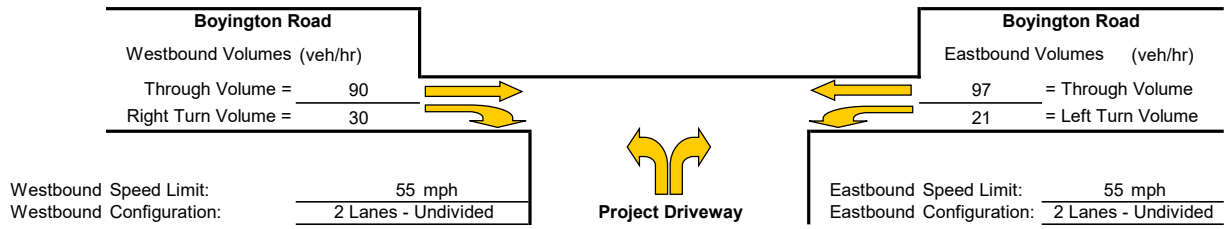
Left Turn Lane Warranted: **NO**

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements* , January 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Boyington Road/Chisom Trail with 100% of Project Volumes
Study Scenario: PM Existing plus Project

Direction of Analysis Street: East/West
Cross Street Intersects: From the North



Westbound Speed Limit: 55 mph
Westbound Configuration: 2 Lanes - Undivided

Eastbound Speed Limit: 55 mph
Eastbound Configuration: 2 Lanes - Undivided

Westbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	120
If AV<Va then warrant is met		-

Right Turn Lane Warranted: **NO**

Westbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	400
Advancing Volume	Va =	120
If AV<Va then warrant is met		No

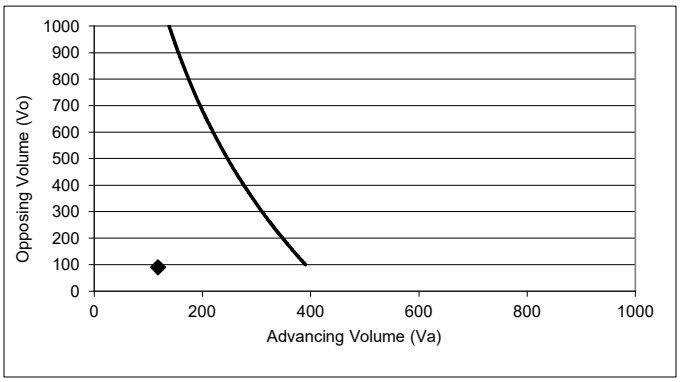
Right Turn Taper Warranted: **NO**

Eastbound Left Turn Lane Warrants

Percentage Left Turns %lt 17.8 %

Advancing Volume Threshold AV 395 veh/hr

If AV<Va then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 55 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements* , January 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Appendix C

Queuing Calculations

This page intentionally left blank

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	96	22	42	56
Average Queue (ft)	37	2	11	10
95th Queue (ft)	77	14	32	37
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			1	0
Queuing Penalty (veh)			1	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	9	33
Average Queue (ft)	1	12
95th Queue (ft)	7	36
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	189	247	125	381	65	305	106	89
Average Queue (ft)	91	121	63	161	55	151	40	22
95th Queue (ft)	163	215	123	296	85	257	85	57
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			3	40	6	0	2	0
Queuing Penalty (veh)			12	96	20	0	6	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	195	64	44	31	29	7
Average Queue (ft)	83	44	15	8	3	0
95th Queue (ft)	153	55	42	25	17	4
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	37	16				
Queuing Penalty (veh)	72	41				

Network Summary

Network wide Queuing Penalty: 247

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	94	6	86	56
Average Queue (ft)	19	0	19	8
95th Queue (ft)	60	6	48	36
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			2	0
Queuing Penalty (veh)			2	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	20	37
Average Queue (ft)	1	17
95th Queue (ft)	10	43
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	199	162	124	247	65	200	128	87
Average Queue (ft)	88	63	60	113	54	98	49	19
95th Queue (ft)	158	123	115	202	82	167	97	54
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			2	29	4		3	0
Queuing Penalty (veh)			7	64	13		6	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB
Directions Served	LT	R	LTR	L	L
Maximum Queue (ft)	214	56	45	29	23
Average Queue (ft)	90	44	20	7	2
95th Queue (ft)	171	53	46	24	13
Link Distance (ft)	850		573		
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		20		80	70
Storage Blk Time (%)	37	19			
Queuing Penalty (veh)	77	47			

Network Summary

Network wide Queuing Penalty: 218

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	143	24	69	58
Average Queue (ft)	50	3	11	11
95th Queue (ft)	105	15	39	42
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			1	1
Queuing Penalty (veh)			1	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	23	33
Average Queue (ft)	1	16
95th Queue (ft)	11	41
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	288	210	125	296	65	374	222	83
Average Queue (ft)	130	107	59	151	57	183	47	23
95th Queue (ft)	265	184	116	266	80	324	170	58
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)							0	
Queuing Penalty (veh)							0	
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			1	36	6	1	1	0
Queuing Penalty (veh)			4	87	21	2	4	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	289	59	43	45	24	7
Average Queue (ft)	112	44	15	14	3	0
95th Queue (ft)	227	53	40	33	16	4
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	46	17				
Queuing Penalty (veh)	89	43				

Network Summary

Network wide Queuing Penalty: 252

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	88	6	94	64
Average Queue (ft)	22	0	21	12
95th Queue (ft)	65	4	55	45
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			2	0
Queuing Penalty (veh)			3	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	24	44
Average Queue (ft)	1	18
95th Queue (ft)	11	44
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	258	128	124	232	68	242	93	62
Average Queue (ft)	113	65	56	101	53	121	42	20
95th Queue (ft)	228	115	107	185	81	219	82	50
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			1	25	5		1	0
Queuing Penalty (veh)			4	55	16		3	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	274	63	45	39	27	10
Average Queue (ft)	104	45	19	10	2	0
95th Queue (ft)	203	55	45	29	15	4
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	42	19				
Queuing Penalty (veh)	89	50				

Network Summary

Network wide Queuing Penalty: 220

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	103	30	44	53
Average Queue (ft)	38	2	11	10
95th Queue (ft)	79	15	30	36
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			1	0
Queuing Penalty (veh)			1	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	15	33
Average Queue (ft)	1	13
95th Queue (ft)	8	37
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	175	224	124	349	65	282	105	93
Average Queue (ft)	89	119	63	159	55	148	42	26
95th Queue (ft)	157	209	123	285	82	245	86	64
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			3	38	5		2	0
Queuing Penalty (veh)			11	91	17		7	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	213	68	49	28	25	6
Average Queue (ft)	85	44	16	7	2	0
95th Queue (ft)	160	57	44	23	13	4
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	38	17				
Queuing Penalty (veh)	75	42				

Network Summary

Network wide Queuing Penalty: 243

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	88	4	64	61
Average Queue (ft)	19	0	18	10
95th Queue (ft)	58	5	44	40
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			1	0
Queuing Penalty (veh)			2	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	26	42
Average Queue (ft)	1	19
95th Queue (ft)	12	45
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	205	157	124	282	65	192	118	79
Average Queue (ft)	91	67	60	120	52	99	47	18
95th Queue (ft)	165	125	115	229	82	164	93	51
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			2	29	5		2	0
Queuing Penalty (veh)			8	63	15		5	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	207	60	50	35	27	7
Average Queue (ft)	94	44	20	9	2	0
95th Queue (ft)	176	54	46	26	14	5
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	38	19				
Queuing Penalty (veh)	81	47				

Network Summary

Network wide Queuing Penalty: 221

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	151	28	60	62
Average Queue (ft)	51	3	13	14
95th Queue (ft)	109	15	40	47
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			1	1
Queuing Penalty (veh)			1	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	34	33
Average Queue (ft)	2	17
95th Queue (ft)	16	42
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	334	236	125	312	67	351	274	73
Average Queue (ft)	175	108	60	152	58	181	53	22
95th Queue (ft)	412	190	115	269	82	323	203	53
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)							0	
Queuing Penalty (veh)							0	
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			1	37	7	2	1	0
Queuing Penalty (veh)			5	90	23	3	5	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	L	TR
Maximum Queue (ft)	305	61	41	51	1	27	10
Average Queue (ft)	124	45	16	15	0	3	0
95th Queue (ft)	254	54	42	37	1	15	6
Link Distance (ft)	850		573		1185		1188
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		20		80		70	
Storage Blk Time (%)	48	17		0			
Queuing Penalty (veh)	96	44		0			

Network Summary

Network wide Queuing Penalty: 266

Intersection: 1: King Road & Boyington Road

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	86	8	72	61
Average Queue (ft)	22	0	21	14
95th Queue (ft)	66	7	52	48
Link Distance (ft)	838	1118	745	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				40
Storage Blk Time (%)			2	0
Queuing Penalty (veh)			3	0

Intersection: 2: Boyington Road & Chisom Trail

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	24	46
Average Queue (ft)	1	20
95th Queue (ft)	11	46
Link Distance (ft)	157	1360
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Penryn Road & Boyington Road/I-80 West Ramps

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R	L	T	R
Maximum Queue (ft)	290	132	124	223	68	256	168	82
Average Queue (ft)	130	65	57	101	53	131	58	20
95th Queue (ft)	266	117	108	181	82	261	190	54
Link Distance (ft)	1070	901		1188			555	
Upstream Blk Time (%)							1	
Queuing Penalty (veh)							0	
Storage Bay Dist (ft)			100		40	420		80
Storage Blk Time (%)			1	25	5	2	2	0
Queuing Penalty (veh)			4	56	15	4	4	0

Intersection: 4: Penryn Road & I-80 East Ramps/Boulder Creek Road

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	264	63	45	38	26	10
Average Queue (ft)	104	45	20	12	1	0
95th Queue (ft)	201	55	45	30	11	4
Link Distance (ft)	850		573			1188
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		20		80	70	
Storage Blk Time (%)	41	20				
Queuing Penalty (veh)	89	52				

Network Summary

Network wide Queuing Penalty: 229

Appendix D

Intersection Level of Service Calculations

This page intentionally left blank

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	123	153	225	121	32	102
Future Vol, veh/h	123	153	225	121	32	102
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	145	180	265	142	38	120

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	407	0	-	0	806	336
Stage 1	-	-	-	-	336	-
Stage 2	-	-	-	-	470	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1152	-	-	-	351	706
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	629	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1152	-	-	-	302	706
Mov Cap-2 Maneuver	-	-	-	-	302	-
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	629	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	12.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1152	-	-	-	302	706
HCM Lane V/C Ratio	0.126	-	-	-	0.125	0.17
HCM Control Delay (s)	8.6	0	-	-	18.6	11.1
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.4	0.6

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	59	143	10	11	7
Future Vol, veh/h	6	59	143	10	11	7
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	69	168	12	13	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	183	0	-	0	263	180
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	86	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1392	-	-	-	726	863
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	937	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1388	-	-	-	718	858
Mov Cap-2 Maneuver	-	-	-	-	718	-
Stage 1	-	-	-	-	847	-
Stage 2	-	-	-	-	934	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1388	-	-	-	767
HCM Lane V/C Ratio	0.005	-	-	-	0.028
HCM Control Delay (s)	7.6	0	-	-	9.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

06/20/2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	78	79	52	110	91	74	250	168	255	93	61
Future Volume (veh/h)	41	78	79	52	110	91	74	250	168	255	93	61
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	48	92	93	61	129	107	87	294	198	300	109	72
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	111	112	72	153	127	116	369	313	342	606	513
Arrive On Green	0.16	0.16	0.16	0.20	0.20	0.20	0.07	0.20	0.20	0.19	0.32	0.32
Sat Flow, veh/h	356	682	690	357	756	627	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	233	0	0	297	0	0	87	294	198	300	109	72
Grp Sat Flow(s),veh/h/ln	1728	0	0	1740	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	10.2	0.0	0.0	12.8	0.0	0.0	3.7	11.7	8.9	12.8	3.3	2.5
Cycle Q Clear(g_c), s	10.2	0.0	0.0	12.8	0.0	0.0	3.7	11.7	8.9	12.8	3.3	2.5
Prop In Lane	0.21		0.40	0.21		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	282	0	0	353	0	0	116	369	313	342	606	513
V/C Ratio(X)	0.83	0.00	0.00	0.84	0.00	0.00	0.75	0.80	0.63	0.88	0.18	0.14
Avail Cap(c_a), veh/h	444	0	0	670	0	0	343	960	814	457	960	814
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.5	0.0	0.0	29.9	0.0	0.0	35.8	29.8	28.7	30.6	18.9	18.7
Incr Delay (d2), s/veh	5.8	0.0	0.0	4.1	0.0	0.0	3.6	3.0	1.6	11.5	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.0	0.0	5.1	0.0	0.0	1.6	5.1	3.3	6.1	1.3	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.3	0.0	0.0	34.0	0.0	0.0	39.3	32.8	30.3	42.1	19.0	18.8
LnGrp LOS	D	A	A	C	A	A	D	C	C	D	B	B
Approach Vol, veh/h		233			297			579			481	
Approach Delay, s/veh		37.3			34.0			32.9			33.4	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	19.0	21.2		17.3	9.2	31.0		20.4				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	20.0	40.0		20.0	15.0	40.0		30.0				
Max Q Clear Time (g_c+I1), s	14.8	13.7		12.2	5.7	5.3		14.8				
Green Ext Time (p_c), s	0.2	1.7		0.6	0.1	0.6		1.0				

Intersection Summary		
HCM 6th Ctrl Delay		33.9
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

06/20/2024

Intersection	
Int Delay, s/veh	17.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	242	11	194	5	3	12	65	238	6	13	128	83
Future Vol, veh/h	242	11	194	5	3	12	65	238	6	13	128	83
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	285	13	228	6	4	14	76	280	7	15	151	98

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	675	669	200	787	715	284	249	0	0	287	0	0
Stage 1	230	230	-	436	436	-	-	-	-	-	-	-
Stage 2	445	439	-	351	279	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	368	379	841	309	356	755	1317	-	-	1275	-	-
Stage 1	773	714	-	599	580	-	-	-	-	-	-	-
Stage 2	592	578	-	666	680	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	339	353	841	207	331	755	1317	-	-	1275	-	-
Mov Cap-2 Maneuver	339	353	-	207	331	-	-	-	-	-	-	-
Stage 1	728	705	-	564	546	-	-	-	-	-	-	-
Stage 2	544	544	-	471	672	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.6	14.4	1.7	0.5
HCM LOS	E	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1317	-	-	340	841	407	1275	-	-
HCM Lane V/C Ratio	0.058	-	-	0.875	0.271	0.058	0.012	-	-
HCM Control Delay (s)	7.9	-	-	58	10.9	14.4	7.9	-	-
HCM Lane LOS	A	-	-	F	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	8.2	1.1	0.2	0	-	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	83	214	139	51	77	127
Future Vol, veh/h	83	214	139	51	77	127
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	98	252	164	60	91	149

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	224	0	-	0	642	194
Stage 1	-	-	-	-	194	-
Stage 2	-	-	-	-	448	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1345	-	-	-	438	847
Stage 1	-	-	-	-	839	-
Stage 2	-	-	-	-	644	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1345	-	-	-	401	847
Mov Cap-2 Maneuver	-	-	-	-	401	-
Stage 1	-	-	-	-	768	-
Stage 2	-	-	-	-	644	-

Approach	EB	WB	SB
HCM Control Delay, s	2.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1345	-	-	-	401	847
HCM Lane V/C Ratio	0.073	-	-	-	0.226	0.176
HCM Control Delay (s)	7.9	0	-	-	16.6	10.2
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.9	0.6

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	9	92	79	12	15	6
Future Vol, veh/h	9	92	79	12	15	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	108	93	14	18	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	107	0	-	0	230	100
Stage 1	-	-	-	-	100	-
Stage 2	-	-	-	-	130	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1484	-	-	-	758	956
Stage 1	-	-	-	-	924	-
Stage 2	-	-	-	-	896	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1484	-	-	-	752	956
Mov Cap-2 Maneuver	-	-	-	-	752	-
Stage 1	-	-	-	-	917	-
Stage 2	-	-	-	-	896	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1484	-	-	-	801
HCM Lane V/C Ratio	0.007	-	-	-	0.031
HCM Control Delay (s)	7.4	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

07/08/2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	90	81	47	68	33	83	229	137	204	123	47
Future Volume (veh/h)	41	90	81	47	68	33	83	229	137	204	123	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	48	106	95	55	80	39	98	269	161	240	145	55
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	62	137	123	73	107	52	145	364	308	295	522	442
Arrive On Green	0.19	0.19	0.19	0.13	0.13	0.13	0.08	0.19	0.19	0.17	0.28	0.28
Sat Flow, veh/h	334	738	662	560	814	397	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	249	0	0	174	0	0	98	269	161	240	145	55
Grp Sat Flow(s),veh/h/ln	1735	0	0	1771	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	8.1	0.0	0.0	5.6	0.0	0.0	3.2	8.0	5.4	7.7	3.6	1.5
Cycle Q Clear(g_c), s	8.1	0.0	0.0	5.6	0.0	0.0	3.2	8.0	5.4	7.7	3.6	1.5
Prop In Lane	0.19		0.38	0.32		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	322	0	0	232	0	0	145	364	308	295	522	442
V/C Ratio(X)	0.77	0.00	0.00	0.75	0.00	0.00	0.68	0.74	0.52	0.81	0.28	0.12
Avail Cap(c_a), veh/h	881	0	0	899	0	0	452	1266	1073	905	1266	1073
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.9	0.0	0.0	24.7	0.0	0.0	26.4	22.4	21.3	23.8	16.7	15.9
Incr Delay (d2), s/veh	3.0	0.0	0.0	3.6	0.0	0.0	2.1	2.2	1.0	2.1	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	0.0	0.0	2.2	0.0	0.0	1.3	3.3	1.8	3.0	1.3	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.8	0.0	0.0	28.4	0.0	0.0	28.5	24.6	22.3	25.9	16.9	16.0
LnGrp LOS	C	A	A	C	A	A	C	C	C	C	B	B
Approach Vol, veh/h		249			174			528			440	
Approach Delay, s/veh		25.8			28.4			24.6			21.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.9	17.3		15.6	8.9	22.3		12.3				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	30.0	40.0		30.0	15.0	40.0		30.0				
Max Q Clear Time (g_c+I1), s	9.7	10.0		10.1	5.2	5.6		7.6				
Green Ext Time (p_c), s	0.3	1.5		1.1	0.1	0.7		0.6				

Intersection Summary		
HCM 6th Ctrl Delay		24.4
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

07/08/2024

Intersection	
Int Delay, s/veh	12.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	244	7	207	8	3	19	61	182	4	12	155	85
Future Vol, veh/h	244	7	207	8	3	19	61	182	4	12	155	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	271	8	230	9	3	21	68	202	4	13	172	94

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	597	587	219	704	632	204	266	0	0	206	0	0
Stage 1	245	245	-	340	340	-	-	-	-	-	-	-
Stage 2	352	342	-	364	292	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	415	422	821	352	398	837	1298	-	-	1365	-	-
Stage 1	759	703	-	675	639	-	-	-	-	-	-	-
Stage 2	665	638	-	655	671	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	383	396	821	238	374	837	1298	-	-	1365	-	-
Mov Cap-2 Maneuver	383	396	-	238	374	-	-	-	-	-	-	-
Stage 1	720	696	-	640	606	-	-	-	-	-	-	-
Stage 2	611	605	-	462	664	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24.6	13.3	2	0.4
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1298	-	-	383	821	466	1365	-	-
HCM Lane V/C Ratio	0.052	-	-	0.728	0.28	0.072	0.01	-	-
HCM Control Delay (s)	7.9	-	-	35.8	11.1	13.3	7.7	-	-
HCM Lane LOS	A	-	-	E	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	5.6	1.1	0.2	0	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	127	235	300	121	34	109
Future Vol, veh/h	127	235	300	121	34	109
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	127	235	300	121	34	109

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	421	0	-	0	850	361
Stage 1	-	-	-	-	361	-
Stage 2	-	-	-	-	489	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1138	-	-	-	331	684
Stage 1	-	-	-	-	705	-
Stage 2	-	-	-	-	616	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1138	-	-	-	289	684
Mov Cap-2 Maneuver	-	-	-	-	289	-
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	616	-

Approach	EB	WB	SB
HCM Control Delay, s	3	0	13.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1138	-	-	-	289	684
HCM Lane V/C Ratio	0.112	-	-	-	0.118	0.159
HCM Control Delay (s)	8.6	0	-	-	19.1	11.3
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.4	0.6

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	9	60	145	10	13	13
Future Vol, veh/h	9	60	145	10	13	13
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	60	145	10	13	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	158	0	-	0	234	156
Stage 1	-	-	-	-	153	-
Stage 2	-	-	-	-	81	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1422	-	-	-	754	890
Stage 1	-	-	-	-	875	-
Stage 2	-	-	-	-	942	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1418	-	-	-	744	885
Mov Cap-2 Maneuver	-	-	-	-	744	-
Stage 1	-	-	-	-	866	-
Stage 2	-	-	-	-	939	-

Approach	EB	WB	SB
HCM Control Delay, s	1	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1418	-	-	-	808
HCM Lane V/C Ratio	0.006	-	-	-	0.032
HCM Control Delay (s)	7.6	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

06/24/2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	80	79	52	110	91	74	256	170	286	94	62
Future Volume (veh/h)	42	80	79	52	110	91	74	256	170	286	94	62
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	42	80	79	52	110	91	74	256	170	286	94	62
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	49	93	92	66	139	115	124	345	292	336	567	480
Arrive On Green	0.14	0.14	0.14	0.18	0.18	0.18	0.07	0.18	0.18	0.19	0.30	0.30
Sat Flow, veh/h	361	689	680	358	756	626	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	201	0	0	253	0	0	74	256	170	286	94	62
Grp Sat Flow(s),veh/h/ln	1730	0	0	1740	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	7.0	0.0	0.0	8.6	0.0	0.0	2.5	8.0	6.1	9.6	2.3	1.8
Cycle Q Clear(g_c), s	7.0	0.0	0.0	8.6	0.0	0.0	2.5	8.0	6.1	9.6	2.3	1.8
Prop In Lane	0.21		0.39	0.21		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	234	0	0	320	0	0	124	345	292	336	567	480
V/C Ratio(X)	0.86	0.00	0.00	0.79	0.00	0.00	0.60	0.74	0.58	0.85	0.17	0.13
Avail Cap(c_a), veh/h	234	0	0	842	0	0	287	983	833	428	1131	959
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.2	0.0	0.0	24.2	0.0	0.0	28.0	23.9	23.1	24.3	15.9	15.7
Incr Delay (d2), s/veh	25.3	0.0	0.0	3.3	0.0	0.0	1.7	2.4	1.4	10.4	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	0.0	3.3	0.0	0.0	1.0	3.3	2.1	4.5	0.9	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.5	0.0	0.0	27.5	0.0	0.0	29.7	26.3	24.5	34.7	16.0	15.8
LnGrp LOS	D	A	A	C	A	A	C	C	C	C	B	B
Approach Vol, veh/h		201			253			500			442	
Approach Delay, s/veh		51.5			27.5			26.2			28.1	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.8	17.2		13.0	8.4	24.6		16.0				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	14.9	32.6		8.4	10.0	37.5		30.0				
Max Q Clear Time (g_c+I1), s	11.6	10.0		9.0	4.5	4.3		10.6				
Green Ext Time (p_c), s	0.1	1.4		0.0	0.0	0.5		0.9				

Intersection Summary		
HCM 6th Ctrl Delay		30.7
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

06/24/2024

Intersection	
Int Delay, s/veh	14.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	246	11	194	5	3	12	121	241	6	13	128	85
Future Vol, veh/h	246	11	194	5	3	12	121	241	6	13	128	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	246	11	194	5	3	12	121	241	6	13	128	85

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	691	686	171	785	725	244	213	0	0	247	0	0
Stage 1	197	197	-	486	486	-	-	-	-	-	-	-
Stage 2	494	489	-	299	239	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	359	370	873	310	352	795	1357	-	-	1319	-	-
Stage 1	805	738	-	563	551	-	-	-	-	-	-	-
Stage 2	557	549	-	710	708	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	325	334	873	218	318	795	1357	-	-	1319	-	-
Mov Cap-2 Maneuver	325	334	-	218	318	-	-	-	-	-	-	-
Stage 1	733	731	-	513	502	-	-	-	-	-	-	-
Stage 2	497	500	-	539	701	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	31.5	14	2.6	0.4
HCM LOS	D	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1357	-	-	325	873	421	1319	-	-
HCM Lane V/C Ratio	0.089	-	-	0.791	0.222	0.048	0.01	-	-
HCM Control Delay (s)	7.9	-	-	47.5	10.3	14	7.8	-	-
HCM Lane LOS	A	-	-	E	B	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	6.4	0.8	0.1	0	-	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	91	323	151	51	78	141
Future Vol, veh/h	91	323	151	51	78	141
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	91	323	151	51	78	141

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	202	0	-	0	682	177
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	505	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1370	-	-	-	415	866
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	606	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1370	-	-	-	381	866
Mov Cap-2 Maneuver	-	-	-	-	381	-
Stage 1	-	-	-	-	785	-
Stage 2	-	-	-	-	606	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1370	-	-	-	381	866
HCM Lane V/C Ratio	0.066	-	-	-	0.205	0.163
HCM Control Delay (s)	7.8	0	-	-	16.9	10
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.8	0.6

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	97	90	15	17	9
Future Vol, veh/h	14	97	90	15	17	9
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	97	90	15	17	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	108	0	-	0	229	104
Stage 1	-	-	-	-	101	-
Stage 2	-	-	-	-	128	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1483	-	-	-	759	951
Stage 1	-	-	-	-	923	-
Stage 2	-	-	-	-	898	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1479	-	-	-	747	946
Mov Cap-2 Maneuver	-	-	-	-	747	-
Stage 1	-	-	-	-	911	-
Stage 2	-	-	-	-	895	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1479	-	-	-	806
HCM Lane V/C Ratio	0.009	-	-	-	0.032
HCM Control Delay (s)	7.5	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

06/24/2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	43	91	85	54	78	38	86	245	139	204	123	47
Future Volume (veh/h)	43	91	85	54	78	38	86	245	139	204	123	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	91	85	54	78	38	86	245	139	204	123	47
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	46	97	90	74	107	52	152	357	303	255	465	394
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.09	0.19	0.19	0.14	0.25	0.25
Sat Flow, veh/h	340	720	672	563	813	396	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	219	0	0	170	0	0	86	245	139	204	123	47
Grp Sat Flow(s),veh/h/ln	1732	0	0	1771	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	6.0	0.0	0.0	4.4	0.0	0.0	2.2	5.8	3.7	5.3	2.5	1.1
Cycle Q Clear(g_c), s	6.0	0.0	0.0	4.4	0.0	0.0	2.2	5.8	3.7	5.3	2.5	1.1
Prop In Lane	0.20		0.39	0.32		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	232	0	0	233	0	0	152	357	303	255	465	394
V/C Ratio(X)	0.94	0.00	0.00	0.73	0.00	0.00	0.56	0.69	0.46	0.80	0.26	0.12
Avail Cap(c_a), veh/h	232	0	0	1114	0	0	381	1239	1050	295	1149	974
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.5	0.0	0.0	19.9	0.0	0.0	21.0	18.0	17.1	19.8	14.4	13.9
Incr Delay (d2), s/veh	42.9	0.0	0.0	3.3	0.0	0.0	1.2	1.7	0.8	11.0	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	0.0	1.6	0.0	0.0	0.8	2.2	1.2	2.6	0.9	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.4	0.0	0.0	23.2	0.0	0.0	22.2	19.7	17.9	30.8	14.6	14.0
LnGrp LOS	E	A	A	C	A	A	C	B	B	C	B	B
Approach Vol, veh/h		219			170			470			374	
Approach Delay, s/veh		63.4			23.2			19.6			23.3	
Approach LOS		E			C			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.9	14.9		11.0	8.2	17.6		10.9				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	7.9	31.6		6.4	10.2	29.3		30.0				
Max Q Clear Time (g_c+I1), s	7.3	7.8		8.0	4.2	4.5		6.4				
Green Ext Time (p_c), s	0.0	1.3		0.0	0.0	0.5		0.6				

Intersection Summary			
HCM 6th Ctrl Delay		29.0	
HCM 6th LOS		C	

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

06/24/2024

Intersection	
Int Delay, s/veh	11.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	258	7	210	8	3	19	77	190	4	12	155	95
Future Vol, veh/h	258	7	210	8	3	19	77	190	4	12	155	95
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	258	7	210	8	3	19	77	190	4	12	155	95

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	584	575	203	681	620	192	250	0	0	194	0	0
Stage 1	227	227	-	346	346	-	-	-	-	-	-	-
Stage 2	357	348	-	335	274	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	423	429	838	364	404	850	1316	-	-	1379	-	-
Stage 1	776	716	-	670	635	-	-	-	-	-	-	-
Stage 2	661	634	-	679	683	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	390	400	838	256	377	850	1316	-	-	1379	-	-
Mov Cap-2 Maneuver	390	400	-	256	377	-	-	-	-	-	-	-
Stage 1	730	710	-	630	598	-	-	-	-	-	-	-
Stage 2	605	597	-	499	677	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.4	12.9	2.2	0.3
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1316	-	-	390	838	487	1379	-	-
HCM Lane V/C Ratio	0.059	-	-	0.679	0.251	0.062	0.009	-	-
HCM Control Delay (s)	7.9	-	-	31.7	10.7	12.9	7.6	-	-
HCM Lane LOS	A	-	-	D	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	4.9	1	0.2	0	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	124	153	225	126	32	104
Future Vol, veh/h	124	153	225	126	32	104
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	146	180	265	148	38	122

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	413	0	-	0	811	339
Stage 1	-	-	-	-	339	-
Stage 2	-	-	-	-	472	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1146	-	-	-	349	703
Stage 1	-	-	-	-	722	-
Stage 2	-	-	-	-	628	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1146	-	-	-	299	703
Mov Cap-2 Maneuver	-	-	-	-	299	-
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	628	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	13
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1146	-	-	-	299	703
HCM Lane V/C Ratio	0.127	-	-	-	0.126	0.174
HCM Control Delay (s)	8.6	0	-	-	18.8	11.2
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.4	0.6

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	61	144	11	12	8
Future Vol, veh/h	8	61	144	11	12	8
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	72	169	13	14	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	185	0	-	0	272	182
Stage 1	-	-	-	-	179	-
Stage 2	-	-	-	-	93	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1390	-	-	-	717	861
Stage 1	-	-	-	-	852	-
Stage 2	-	-	-	-	931	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1386	-	-	-	708	856
Mov Cap-2 Maneuver	-	-	-	-	708	-
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	928	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1386	-	-	-	761
HCM Lane V/C Ratio	0.007	-	-	-	0.031
HCM Control Delay (s)	7.6	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

02/10/2025

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	81	79	52	112	91	74	250	168	255	93	61
Future Volume (veh/h)	41	81	79	52	112	91	74	250	168	255	93	61
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	48	95	93	61	132	107	87	294	198	300	109	72
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	114	112	72	156	127	116	368	312	341	605	513
Arrive On Green	0.16	0.16	0.16	0.20	0.20	0.20	0.06	0.20	0.20	0.19	0.32	0.32
Sat Flow, veh/h	352	696	682	354	766	621	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	236	0	0	300	0	0	87	294	198	300	109	72
Grp Sat Flow(s),veh/h/ln	1730	0	0	1741	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	10.4	0.0	0.0	13.0	0.0	0.0	3.8	11.8	9.0	12.9	3.3	2.5
Cycle Q Clear(g_c), s	10.4	0.0	0.0	13.0	0.0	0.0	3.8	11.8	9.0	12.9	3.3	2.5
Prop In Lane	0.20		0.39	0.20		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	284	0	0	355	0	0	116	368	312	341	605	513
V/C Ratio(X)	0.83	0.00	0.00	0.84	0.00	0.00	0.75	0.80	0.63	0.88	0.18	0.14
Avail Cap(c_a), veh/h	440	0	0	665	0	0	340	952	807	453	952	807
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.8	0.0	0.0	30.1	0.0	0.0	36.1	30.1	29.0	30.9	19.1	18.8
Incr Delay (d2), s/veh	6.3	0.0	0.0	4.2	0.0	0.0	3.7	3.0	1.6	11.9	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	0.0	5.3	0.0	0.0	1.7	5.2	3.3	6.2	1.3	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.1	0.0	0.0	34.2	0.0	0.0	39.8	33.1	30.6	42.8	19.2	18.9
LnGrp LOS	D	A	A	C	A	A	D	C	C	D	B	B
Approach Vol, veh/h		236			300			579			481	
Approach Delay, s/veh		38.1			34.2			33.2			33.9	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	19.2	21.3		17.5	9.2	31.2		20.6				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	20.0	40.0		20.0	15.0	40.0		30.0				
Max Q Clear Time (g_c+I1), s	14.9	13.8		12.4	5.8	5.3		15.0				
Green Ext Time (p_c), s	0.2	1.7		0.6	0.1	0.6		1.0				

Intersection Summary		
HCM 6th Ctrl Delay		34.3
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

02/10/2025

Intersection	
Int Delay, s/veh	17.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	242	11	199	5	3	12	65	238	6	13	128	83
Future Vol, veh/h	242	11	199	5	3	12	65	238	6	13	128	83
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	285	13	234	6	4	14	76	280	7	15	151	98

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	675	669	200	790	715	284	249	0	0	287	0	0
Stage 1	230	230	-	436	436	-	-	-	-	-	-	-
Stage 2	445	439	-	354	279	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	368	379	841	308	356	755	1317	-	-	1275	-	-
Stage 1	773	714	-	599	580	-	-	-	-	-	-	-
Stage 2	592	578	-	663	680	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	339	353	841	205	331	755	1317	-	-	1275	-	-
Mov Cap-2 Maneuver	339	353	-	205	331	-	-	-	-	-	-	-
Stage 1	728	705	-	564	546	-	-	-	-	-	-	-
Stage 2	544	544	-	464	672	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.3	14.4	1.7	0.5
HCM LOS	E	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1317	-	-	340	841	405	1275	-	-
HCM Lane V/C Ratio	0.058	-	-	0.875	0.278	0.058	0.012	-	-
HCM Control Delay (s)	7.9	-	-	58	10.9	14.4	7.9	-	-
HCM Lane LOS	A	-	-	F	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	8.2	1.1	0.2	0	-	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	85	214	139	57	77	132
Future Vol, veh/h	85	214	139	57	77	132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	100	252	164	67	91	155

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	231	0	-	0	650	198
Stage 1	-	-	-	-	198	-
Stage 2	-	-	-	-	452	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1337	-	-	-	434	843
Stage 1	-	-	-	-	835	-
Stage 2	-	-	-	-	641	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1337	-	-	-	396	843
Mov Cap-2 Maneuver	-	-	-	-	396	-
Stage 1	-	-	-	-	762	-
Stage 2	-	-	-	-	641	-

Approach	EB	WB	SB
HCM Control Delay, s	2.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1337	-	-	-	396	843
HCM Lane V/C Ratio	0.075	-	-	-	0.229	0.184
HCM Control Delay (s)	7.9	0	-	-	16.8	10.2
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.9	0.7

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	12	97	80	13	18	8
Future Vol, veh/h	12	97	80	13	18	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	114	94	15	21	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	109	0	-	0	244	102
Stage 1	-	-	-	-	102	-
Stage 2	-	-	-	-	142	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1481	-	-	-	744	953
Stage 1	-	-	-	-	922	-
Stage 2	-	-	-	-	885	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1481	-	-	-	737	953
Mov Cap-2 Maneuver	-	-	-	-	737	-
Stage 1	-	-	-	-	913	-
Stage 2	-	-	-	-	885	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1481	-	-	-	792
HCM Lane V/C Ratio	0.01	-	-	-	0.039
HCM Control Delay (s)	7.5	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

02/10/2025

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	95	84	47	70	33	83	229	137	204	123	47
Future Volume (veh/h)	41	95	84	47	70	33	83	229	137	204	123	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	48	112	99	55	82	39	98	269	161	240	145	55
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	62	144	127	73	109	52	143	362	307	294	521	441
Arrive On Green	0.19	0.19	0.19	0.13	0.13	0.13	0.08	0.19	0.19	0.17	0.28	0.28
Sat Flow, veh/h	322	750	663	554	826	393	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	259	0	0	176	0	0	98	269	161	240	145	55
Grp Sat Flow(s),veh/h/ln	1735	0	0	1772	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	8.5	0.0	0.0	5.8	0.0	0.0	3.2	8.1	5.5	7.8	3.6	1.6
Cycle Q Clear(g_c), s	8.5	0.0	0.0	5.8	0.0	0.0	3.2	8.1	5.5	7.8	3.6	1.6
Prop In Lane	0.19		0.38	0.31		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	332	0	0	234	0	0	143	362	307	294	521	441
V/C Ratio(X)	0.78	0.00	0.00	0.75	0.00	0.00	0.68	0.74	0.52	0.82	0.28	0.12
Avail Cap(c_a), veh/h	866	0	0	884	0	0	445	1245	1055	889	1245	1055
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.1	0.0	0.0	25.2	0.0	0.0	26.9	22.8	21.7	24.2	17.0	16.2
Incr Delay (d2), s/veh	3.0	0.0	0.0	3.7	0.0	0.0	2.2	2.3	1.0	2.1	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	0.0	0.0	2.3	0.0	0.0	1.3	3.3	1.9	3.0	1.4	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.1	0.0	0.0	28.8	0.0	0.0	29.1	25.1	22.8	26.3	17.2	16.3
LnGrp LOS	C	A	A	C	A	A	C	C	C	C	B	B
Approach Vol, veh/h		259			176			528			440	
Approach Delay, s/veh		26.1			28.8			25.1			22.1	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	14.0	17.4		16.1	8.9	22.5		12.5				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	30.0	40.0		30.0	15.0	40.0		30.0				
Max Q Clear Time (g_c+I1), s	9.8	10.1		10.5	5.2	5.6		7.8				
Green Ext Time (p_c), s	0.3	1.5		1.1	0.1	0.7		0.6				

Intersection Summary		
HCM 6th Ctrl Delay		24.8
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

02/10/2025

Intersection	
Int Delay, s/veh	12.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	244	7	213	8	3	19	61	182	4	12	155	88
Future Vol, veh/h	244	7	213	8	3	19	61	182	4	12	155	88
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	271	8	237	9	3	21	68	202	4	13	172	98

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	599	589	221	710	636	204	270	0	0	206	0	0
Stage 1	247	247	-	340	340	-	-	-	-	-	-	-
Stage 2	352	342	-	370	296	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	413	421	819	348	395	837	1293	-	-	1365	-	-
Stage 1	757	702	-	675	639	-	-	-	-	-	-	-
Stage 2	665	638	-	650	668	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	381	395	819	232	371	837	1293	-	-	1365	-	-
Mov Cap-2 Maneuver	381	395	-	232	371	-	-	-	-	-	-	-
Stage 1	717	695	-	639	605	-	-	-	-	-	-	-
Stage 2	611	604	-	453	661	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24.8	13.4	2	0.4
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1293	-	-	381	819	460	1365	-	-
HCM Lane V/C Ratio	0.052	-	-	0.732	0.289	0.072	0.01	-	-
HCM Control Delay (s)	7.9	-	-	36.3	11.2	13.4	7.7	-	-
HCM Lane LOS	A	-	-	E	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	5.7	1.2	0.2	0	-	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	128	235	300	126	34	111
Future Vol, veh/h	128	235	300	126	34	111
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	128	235	300	126	34	111

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	426	0	-	0	854	363
Stage 1	-	-	-	-	363	-
Stage 2	-	-	-	-	491	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1133	-	-	-	329	682
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	615	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1133	-	-	-	286	682
Mov Cap-2 Maneuver	-	-	-	-	286	-
Stage 1	-	-	-	-	612	-
Stage 2	-	-	-	-	615	-

Approach	EB	WB	SB
HCM Control Delay, s	3	0	13.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1133	-	-	-	286	682
HCM Lane V/C Ratio	0.113	-	-	-	0.119	0.163
HCM Control Delay (s)	8.6	0	-	-	19.3	11.3
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.4	0.6

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	11	62	146	11	14	14
Future Vol, veh/h	11	62	146	11	14	14
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	62	146	11	14	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	160	0	-	0	242	158
Stage 1	-	-	-	-	155	-
Stage 2	-	-	-	-	87	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1419	-	-	-	746	887
Stage 1	-	-	-	-	873	-
Stage 2	-	-	-	-	936	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1415	-	-	-	736	882
Mov Cap-2 Maneuver	-	-	-	-	736	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	933	-

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1415	-	-	-	802
HCM Lane V/C Ratio	0.008	-	-	-	0.035
HCM Control Delay (s)	7.6	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

02/10/2025

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	83	79	52	112	91	74	256	170	286	94	62
Future Volume (veh/h)	42	83	79	52	112	91	74	256	170	286	94	62
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	42	83	79	52	112	91	74	256	170	286	94	62
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	48	95	91	66	141	115	124	345	292	336	567	480
Arrive On Green	0.14	0.14	0.14	0.18	0.18	0.18	0.07	0.18	0.18	0.19	0.30	0.30
Sat Flow, veh/h	357	705	671	355	765	621	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	204	0	0	255	0	0	74	256	170	286	94	62
Grp Sat Flow(s),veh/h/ln	1732	0	0	1741	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	7.2	0.0	0.0	8.7	0.0	0.0	2.5	8.0	6.1	9.6	2.3	1.8
Cycle Q Clear(g_c), s	7.2	0.0	0.0	8.7	0.0	0.0	2.5	8.0	6.1	9.6	2.3	1.8
Prop In Lane	0.21		0.39	0.20		0.36	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	234	0	0	322	0	0	124	345	292	336	567	480
V/C Ratio(X)	0.87	0.00	0.00	0.79	0.00	0.00	0.60	0.74	0.58	0.85	0.17	0.13
Avail Cap(c_a), veh/h	234	0	0	840	0	0	287	981	832	427	1129	957
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.3	0.0	0.0	24.2	0.0	0.0	28.1	24.0	23.2	24.4	15.9	15.7
Incr Delay (d2), s/veh	27.6	0.0	0.0	3.3	0.0	0.0	1.7	2.4	1.4	10.5	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.0	0.0	3.3	0.0	0.0	1.0	3.3	2.1	4.5	0.9	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.0	0.0	0.0	27.5	0.0	0.0	29.8	26.3	24.5	34.9	16.0	15.8
LnGrp LOS	D	A	A	C	A	A	C	C	C	C	B	B
Approach Vol, veh/h		204			255			500			442	
Approach Delay, s/veh		54.0			27.5			26.2			28.2	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.8	17.3		13.0	8.4	24.6		16.1				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	14.9	32.6		8.4	10.0	37.5		30.0				
Max Q Clear Time (g_c+I1), s	11.6	10.0		9.2	4.5	4.3		10.7				
Green Ext Time (p_c), s	0.1	1.4		0.0	0.0	0.5		0.9				

Intersection Summary		
HCM 6th Ctrl Delay		31.1
HCM 6th LOS		C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

02/10/2025

Intersection	
Int Delay, s/veh	14.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	246	11	199	5	3	12	121	241	6	13	128	85
Future Vol, veh/h	246	11	199	5	3	12	121	241	6	13	128	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	246	11	199	5	3	12	121	241	6	13	128	85

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	691	686	171	788	725	244	213	0	0	247	0	0
Stage 1	197	197	-	486	486	-	-	-	-	-	-	-
Stage 2	494	489	-	302	239	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	359	370	873	309	352	795	1357	-	-	1319	-	-
Stage 1	805	738	-	563	551	-	-	-	-	-	-	-
Stage 2	557	549	-	707	708	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	325	334	873	215	318	795	1357	-	-	1319	-	-
Mov Cap-2 Maneuver	325	334	-	215	318	-	-	-	-	-	-	-
Stage 1	733	731	-	513	502	-	-	-	-	-	-	-
Stage 2	497	500	-	532	701	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	31.3	14	2.6	0.4
HCM LOS	D	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1357	-	-	325	873	419	1319	-	-
HCM Lane V/C Ratio	0.089	-	-	0.791	0.228	0.048	0.01	-	-
HCM Control Delay (s)	7.9	-	-	47.5	10.3	14	7.8	-	-
HCM Lane LOS	A	-	-	E	B	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	6.4	0.9	0.1	0	-	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	93	323	151	57	78	146
Future Vol, veh/h	93	323	151	57	78	146
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	0	40
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	93	323	151	57	78	146

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	208	0	-	0	689	180
Stage 1	-	-	-	-	180	-
Stage 2	-	-	-	-	509	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1363	-	-	-	412	863
Stage 1	-	-	-	-	851	-
Stage 2	-	-	-	-	604	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1363	-	-	-	378	863
Mov Cap-2 Maneuver	-	-	-	-	378	-
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	604	-

Approach	EB	WB	SB
HCM Control Delay, s	1.8	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1363	-	-	-	378	863
HCM Lane V/C Ratio	0.068	-	-	-	0.206	0.169
HCM Control Delay (s)	7.8	0	-	-	17	10
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.8	0.6

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	17	102	91	16	20	11
Future Vol, veh/h	17	102	91	16	20	11
Conflicting Peds, #/hr	3	0	0	3	3	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	102	91	16	20	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	110	0	-	0	241	105
Stage 1	-	-	-	-	102	-
Stage 2	-	-	-	-	139	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1480	-	-	-	747	949
Stage 1	-	-	-	-	922	-
Stage 2	-	-	-	-	888	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1476	-	-	-	734	944
Mov Cap-2 Maneuver	-	-	-	-	734	-
Stage 1	-	-	-	-	908	-
Stage 2	-	-	-	-	885	-

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1476	-	-	-	797
HCM Lane V/C Ratio	0.012	-	-	-	0.039
HCM Control Delay (s)	7.5	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Penryn Road & Boyington Road/I-80 West Ramps

02/10/2025

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	43	96	88	54	80	38	86	245	139	204	123	47
Future Volume (veh/h)	43	96	88	54	80	38	86	245	139	204	123	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	96	88	54	80	38	86	245	139	204	123	47
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	98	90	74	109	52	152	357	303	255	465	394
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.09	0.19	0.19	0.14	0.25	0.25
Sat Flow, veh/h	328	733	672	556	824	392	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	227	0	0	172	0	0	86	245	139	204	123	47
Grp Sat Flow(s),veh/h/ln	1733	0	0	1772	0	0	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	6.2	0.0	0.0	4.5	0.0	0.0	2.2	5.8	3.7	5.3	2.5	1.1
Cycle Q Clear(g_c), s	6.2	0.0	0.0	4.5	0.0	0.0	2.2	5.8	3.7	5.3	2.5	1.1
Prop In Lane	0.19		0.39	0.31		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	232	0	0	235	0	0	152	357	303	255	465	394
V/C Ratio(X)	0.98	0.00	0.00	0.73	0.00	0.00	0.56	0.69	0.46	0.80	0.26	0.12
Avail Cap(c_a), veh/h	232	0	0	1112	0	0	380	1236	1048	294	1147	972
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.6	0.0	0.0	19.9	0.0	0.0	21.0	18.0	17.1	19.8	14.5	13.9
Incr Delay (d2), s/veh	52.7	0.0	0.0	3.3	0.0	0.0	1.2	1.7	0.8	11.1	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	0.0	0.0	1.6	0.0	0.0	0.8	2.2	1.2	2.6	0.9	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	73.3	0.0	0.0	23.2	0.0	0.0	22.2	19.7	18.0	30.9	14.7	14.0
LnGrp LOS	E	A	A	C	A	A	C	B	B	C	B	B
Approach Vol, veh/h		227			172			470			374	
Approach Delay, s/veh		73.3			23.2			19.7			23.4	
Approach LOS		E			C			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.9	14.9		11.0	8.2	17.7		10.9				
Change Period (Y+Rc), s	4.1	5.8		4.6	4.1	5.8		4.6				
Max Green Setting (Gmax), s	7.9	31.6		6.4	10.2	29.3		30.0				
Max Q Clear Time (g_c+I1), s	7.3	7.8		8.2	4.2	4.5		6.5				
Green Ext Time (p_c), s	0.0	1.3		0.0	0.0	0.5		0.6				

Intersection Summary	
HCM 6th Ctrl Delay	31.1
HCM 6th LOS	C

HCM 6th TWSC
4: Penryn Road & I-80 East Ramps/Boulder Creek Road

02/10/2025

Intersection	
Int Delay, s/veh	11.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	258	7	216	8	3	19	77	190	4	12	155	98
Future Vol, veh/h	258	7	216	8	3	19	77	190	4	12	155	98
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	20	-	-	-	80	-	-	70	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	258	7	216	8	3	19	77	190	4	12	155	98

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	585	576	204	686	623	192	253	0	0	194	0	0
Stage 1	228	228	-	346	346	-	-	-	-	-	-	-
Stage 2	357	348	-	340	277	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	422	428	837	362	402	850	1312	-	-	1379	-	-
Stage 1	775	715	-	670	635	-	-	-	-	-	-	-
Stage 2	661	634	-	675	681	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	389	399	837	252	375	850	1312	-	-	1379	-	-
Mov Cap-2 Maneuver	389	399	-	252	375	-	-	-	-	-	-	-
Stage 1	729	709	-	630	598	-	-	-	-	-	-	-
Stage 2	605	597	-	492	675	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.4	12.9	2.2	0.3
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1312	-	-	389	837	483	1379	-	-
HCM Lane V/C Ratio	0.059	-	-	0.681	0.258	0.062	0.009	-	-
HCM Control Delay (s)	7.9	-	-	31.9	10.8	12.9	7.6	-	-
HCM Lane LOS	A	-	-	D	B	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	4.9	1	0.2	0	-	-

Intersection	
Intersection Delay, s/veh	15.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	242	11	194	5	3	12	65	238	6	13	128	83
Future Vol, veh/h	242	11	194	5	3	12	65	238	6	13	128	83
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	285	13	228	6	4	14	76	280	7	15	151	98
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	15.7	10.6	15.4	14.3
HCM LOS	C	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	96%	0%	25%	100%	0%
Vol Thru, %	0%	98%	4%	0%	15%	0%	61%
Vol Right, %	0%	2%	0%	100%	60%	0%	39%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	65	244	253	194	20	13	211
LT Vol	65	0	242	0	5	13	0
Through Vol	0	238	11	0	3	0	128
RT Vol	0	6	0	194	12	0	83
Lane Flow Rate	76	287	298	228	24	15	248
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.151	0.525	0.573	0.364	0.047	0.031	0.447
Departure Headway (Hd)	7.106	6.579	6.933	5.739	7.242	7.278	6.486
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	503	545	518	623	497	490	554
Service Time	4.876	4.349	4.695	3.501	5.242	5.053	4.261
HCM Lane V/C Ratio	0.151	0.527	0.575	0.366	0.048	0.031	0.448
HCM Control Delay	11.1	16.5	18.7	11.8	10.6	10.3	14.5
HCM Lane LOS	B	C	C	B	B	B	B
HCM 95th-tile Q	0.5	3	3.6	1.7	0.1	0.1	2.3

Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	244	7	207	8	3	19	61	182	4	12	155	85
Future Vol, veh/h	244	7	207	8	3	19	61	182	4	12	155	85
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	271	8	230	9	3	21	68	202	4	13	172	94
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	14.3	10.4	12.6	14.3
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	97%	0%	27%	100%	0%
Vol Thru, %	0%	98%	3%	0%	10%	0%	65%
Vol Right, %	0%	2%	0%	100%	63%	0%	35%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	61	186	251	207	30	12	240
LT Vol	61	0	244	0	8	12	0
Through Vol	0	182	7	0	3	0	155
RT Vol	0	4	0	207	19	0	85
Lane Flow Rate	68	207	279	230	33	13	267
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.133	0.375	0.523	0.355	0.063	0.026	0.467
Departure Headway (Hd)	7.064	6.539	6.75	5.55	6.807	7.067	6.305
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	506	548	533	646	523	505	571
Service Time	4.827	4.302	4.503	3.303	4.893	4.829	4.066
HCM Lane V/C Ratio	0.134	0.378	0.523	0.356	0.063	0.026	0.468
HCM Control Delay	10.9	13.2	16.7	11.4	10.4	10	14.5
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.5	1.7	3	1.6	0.2	0.1	2.5

Intersection	
Intersection Delay, s/veh	13.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	246	11	194	5	3	12	121	241	6	13	128	85
Future Vol, veh/h	246	11	194	5	3	12	121	241	6	13	128	85
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	246	11	194	5	3	12	121	241	6	13	128	85
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	13.5	10.1	13	12.5
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	96%	0%	25%	100%	0%
Vol Thru, %	0%	98%	4%	0%	15%	0%	60%
Vol Right, %	0%	2%	0%	100%	60%	0%	40%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	121	247	257	194	20	13	213
LT Vol	121	0	246	0	5	13	0
Through Vol	0	241	11	0	3	0	128
RT Vol	0	6	0	194	12	0	85
Lane Flow Rate	121	247	257	194	20	13	213
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.228	0.43	0.483	0.3	0.038	0.025	0.368
Departure Headway (Hd)	6.789	6.264	6.759	5.567	6.769	7.015	6.221
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	529	573	532	644	527	509	577
Service Time	4.538	4.013	4.504	3.311	4.841	4.771	3.976
HCM Lane V/C Ratio	0.229	0.431	0.483	0.301	0.038	0.026	0.369
HCM Control Delay	11.5	13.7	15.7	10.7	10.1	10	12.6
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.9	2.1	2.6	1.3	0.1	0.1	1.7

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	258	7	210	8	3	19	77	190	4	12	155	95
Future Vol, veh/h	258	7	210	8	3	19	77	190	4	12	155	95
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	258	7	210	8	3	19	77	190	4	12	155	95
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	13.5	10.1	12	13.3
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	97%	0%	27%	100%	0%
Vol Thru, %	0%	98%	3%	0%	10%	0%	62%
Vol Right, %	0%	2%	0%	100%	63%	0%	38%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	77	194	265	210	30	12	250
LT Vol	77	0	258	0	8	12	0
Through Vol	0	190	7	0	3	0	155
RT Vol	0	4	0	210	19	0	95
Lane Flow Rate	77	194	265	210	30	12	250
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.148	0.344	0.49	0.318	0.055	0.023	0.428
Departure Headway (Hd)	6.911	6.388	6.654	5.454	6.635	6.938	6.159
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	518	563	541	657	537	515	583
Service Time	4.664	4.14	4.398	3.198	4.708	4.691	3.912
HCM Lane V/C Ratio	0.149	0.345	0.49	0.32	0.056	0.023	0.429
HCM Control Delay	10.9	12.5	15.7	10.7	10.1	9.9	13.5
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.5	1.5	2.7	1.4	0.2	0.1	2.1

Intersection	
Intersection Delay, s/veh	15.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	242	11	199	5	3	12	65	238	6	13	128	83
Future Vol, veh/h	242	11	199	5	3	12	65	238	6	13	128	83
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	285	13	234	6	4	14	76	280	7	15	151	98
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	15.7	10.6	15.4	14.3
HCM LOS	C	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	96%	0%	25%	100%	0%
Vol Thru, %	0%	98%	4%	0%	15%	0%	61%
Vol Right, %	0%	2%	0%	100%	60%	0%	39%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	65	244	253	199	20	13	211
LT Vol	65	0	242	0	5	13	0
Through Vol	0	238	11	0	3	0	128
RT Vol	0	6	0	199	12	0	83
Lane Flow Rate	76	287	298	234	24	15	248
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.151	0.526	0.573	0.373	0.047	0.031	0.448
Departure Headway (Hd)	7.122	6.595	6.936	5.742	7.253	7.294	6.502
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	502	545	518	623	497	489	551
Service Time	4.889	4.361	4.698	3.504	5.253	5.066	4.273
HCM Lane V/C Ratio	0.151	0.527	0.575	0.376	0.048	0.031	0.45
HCM Control Delay	11.2	16.5	18.7	11.9	10.6	10.3	14.5
HCM Lane LOS	B	C	C	B	B	B	B
HCM 95th-tile Q	0.5	3	3.6	1.7	0.1	0.1	2.3

Intersection	
Intersection Delay, s/veh	13.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	244	7	214	8	3	19	61	182	4	12	155	88
Future Vol, veh/h	244	7	214	8	3	19	61	182	4	12	155	88
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	271	8	238	9	3	21	68	202	4	13	172	98
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	14.4	10.4	12.7	14.5
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	97%	0%	27%	100%	0%
Vol Thru, %	0%	98%	3%	0%	10%	0%	64%
Vol Right, %	0%	2%	0%	100%	63%	0%	36%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	61	186	251	214	30	12	243
LT Vol	61	0	244	0	8	12	0
Through Vol	0	182	7	0	3	0	155
RT Vol	0	4	0	214	19	0	88
Lane Flow Rate	68	207	279	238	33	13	270
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.133	0.377	0.524	0.368	0.063	0.026	0.474
Departure Headway (Hd)	7.089	6.564	6.765	5.565	6.836	7.087	6.319
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	504	546	533	644	521	504	567
Service Time	4.853	4.328	4.518	3.317	4.922	4.85	4.082
HCM Lane V/C Ratio	0.135	0.379	0.523	0.37	0.063	0.026	0.476
HCM Control Delay	10.9	13.3	16.8	11.6	10.4	10	14.7
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.5	1.7	3	1.7	0.2	0.1	2.5

Intersection	
Intersection Delay, s/veh	13.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	246	11	199	5	3	12	121	241	6	13	128	85
Future Vol, veh/h	246	11	199	5	3	12	121	241	6	13	128	85
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	246	11	199	5	3	12	121	241	6	13	128	85
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	13.6	10.1	13	12.5
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	96%	0%	25%	100%	0%
Vol Thru, %	0%	98%	4%	0%	15%	0%	60%
Vol Right, %	0%	2%	0%	100%	60%	0%	40%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	121	247	257	199	20	13	213
LT Vol	121	0	246	0	5	13	0
Through Vol	0	241	11	0	3	0	128
RT Vol	0	6	0	199	12	0	85
Lane Flow Rate	121	247	257	199	20	13	213
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.229	0.43	0.483	0.308	0.038	0.025	0.369
Departure Headway (Hd)	6.799	6.274	6.761	5.569	6.776	7.026	6.232
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	528	573	532	645	526	508	575
Service Time	4.551	4.025	4.507	3.314	4.85	4.783	3.989
HCM Lane V/C Ratio	0.229	0.431	0.483	0.309	0.038	0.026	0.37
HCM Control Delay	11.6	13.7	15.7	10.8	10.1	10	12.6
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.9	2.1	2.6	1.3	0.1	0.1	1.7

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	258	7	216	8	3	19	77	190	4	12	155	98
Future Vol, veh/h	258	7	216	8	3	19	77	190	4	12	155	98
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	258	7	216	8	3	19	77	190	4	12	155	98
Number of Lanes	0	1	1	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	13.5	10.1	12	13.4
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	97%	0%	27%	100%	0%
Vol Thru, %	0%	98%	3%	0%	10%	0%	61%
Vol Right, %	0%	2%	0%	100%	63%	0%	39%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	77	194	265	216	30	12	253
LT Vol	77	0	258	0	8	12	0
Through Vol	0	190	7	0	3	0	155
RT Vol	0	4	0	216	19	0	98
Lane Flow Rate	77	194	265	216	30	12	253
Geometry Grp	5	5	5	5	4b	5	5
Degree of Util (X)	0.148	0.345	0.491	0.328	0.055	0.023	0.434
Departure Headway (Hd)	6.933	6.409	6.665	5.465	6.658	6.955	6.171
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	517	561	541	657	535	514	582
Service Time	4.686	4.162	4.409	3.209	4.731	4.708	3.923
HCM Lane V/C Ratio	0.149	0.346	0.49	0.329	0.056	0.023	0.435
HCM Control Delay	10.9	12.5	15.7	10.9	10.1	9.9	13.6
HCM Lane LOS	B	B	C	B	B	A	B
HCM 95th-tile Q	0.5	1.5	2.7	1.4	0.2	0.1	2.2

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	526	24	363	264
Demand Flow Rate, veh/h	537	24	371	269
Vehicles Circulating, veh/h	175	655	319	88
Vehicles Exiting, veh/h	182	35	393	591
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.3	5.5	7.7	4.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	537	24	371	269
Cap Entry Lane, veh/h	1154	707	997	1261
Entry HV Adj Factor	0.979	0.997	0.979	0.981
Flow Entry, veh/h	526	24	363	264
Cap Entry, veh/h	1130	705	976	1238
V/C Ratio	0.465	0.034	0.372	0.213
Control Delay, s/veh	8.3	5.5	7.7	4.8
LOS	A	A	A	A
95th %tile Queue, veh	3	0	2	1

Intersection	
Intersection Delay, s/veh	6.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	509	33	274	279
Demand Flow Rate, veh/h	519	33	279	284
Vehicles Circulating, veh/h	197	551	297	81
Vehicles Exiting, veh/h	168	25	419	503
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.3	5.0	6.3	4.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	519	33	279	284
Cap Entry Lane, veh/h	1129	787	1019	1270
Entry HV Adj Factor	0.980	0.998	0.982	0.981
Flow Entry, veh/h	509	33	274	279
Cap Entry, veh/h	1107	785	1001	1246
V/C Ratio	0.460	0.042	0.274	0.224
Control Delay, s/veh	8.3	5.0	6.3	4.8
LOS	A	A	A	A
95th %tile Queue, veh	2	0	1	1

Intersection	
Intersection Delay, s/veh	6.6
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	451	20	368	226
Demand Flow Rate, veh/h	460	20	375	231
Vehicles Circulating, veh/h	149	620	275	131
Vehicles Exiting, veh/h	213	30	334	509
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.0	5.2	7.3	4.7
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	460	20	375	231
Cap Entry Lane, veh/h	1185	733	1042	1207
Entry HV Adj Factor	0.980	0.997	0.982	0.980
Flow Entry, veh/h	451	20	368	226
Cap Entry, veh/h	1162	731	1023	1183
V/C Ratio	0.388	0.027	0.360	0.191
Control Delay, s/veh	7.0	5.2	7.3	4.7
LOS	A	A	A	A
95th %tile Queue, veh	2	0	2	1

Intersection	
Intersection Delay, s/veh	6.4
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	475	30	271	262
Demand Flow Rate, veh/h	484	30	277	267
Vehicles Circulating, veh/h	178	536	282	90
Vehicles Exiting, veh/h	179	23	380	476
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.6	4.9	6.2	4.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	484	30	277	267
Cap Entry Lane, veh/h	1151	799	1035	1259
Entry HV Adj Factor	0.981	0.998	0.979	0.981
Flow Entry, veh/h	475	30	271	262
Cap Entry, veh/h	1129	797	1013	1235
V/C Ratio	0.421	0.038	0.268	0.212
Control Delay, s/veh	7.6	4.9	6.2	4.8
LOS	A	A	A	A
95th %tile Queue, veh	2	0	1	1

Intersection	
Intersection Delay, s/veh	7.3
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	532	24	363	264
Demand Flow Rate, veh/h	543	24	371	269
Vehicles Circulating, veh/h	175	655	319	88
Vehicles Exiting, veh/h	182	35	399	591
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.3	5.5	7.7	4.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	543	24	371	269
Cap Entry Lane, veh/h	1154	707	997	1261
Entry HV Adj Factor	0.979	0.997	0.979	0.981
Flow Entry, veh/h	532	24	363	264
Cap Entry, veh/h	1130	705	976	1238
V/C Ratio	0.470	0.034	0.372	0.213
Control Delay, s/veh	8.3	5.5	7.7	4.8
LOS	A	A	A	A
95th %tile Queue, veh	3	0	2	1

Intersection	
Intersection Delay, s/veh	6.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	516	33	274	283
Demand Flow Rate, veh/h	526	33	279	288
Vehicles Circulating, veh/h	197	551	297	81
Vehicles Exiting, veh/h	172	25	426	503
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.4	5.0	6.3	4.9
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	526	33	279	288
Cap Entry Lane, veh/h	1129	787	1019	1270
Entry HV Adj Factor	0.981	0.998	0.982	0.981
Flow Entry, veh/h	516	33	274	283
Cap Entry, veh/h	1107	785	1001	1246
V/C Ratio	0.466	0.042	0.274	0.227
Control Delay, s/veh	8.4	5.0	6.3	4.9
LOS	A	A	A	A
95th %tile Queue, veh	3	0	1	1

Intersection	
Intersection Delay, s/veh	6.6
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	456	20	368	226
Demand Flow Rate, veh/h	465	20	375	231
Vehicles Circulating, veh/h	149	620	275	131
Vehicles Exiting, veh/h	213	30	339	509
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.0	5.2	7.3	4.7
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	465	20	375	231
Cap Entry Lane, veh/h	1185	733	1042	1207
Entry HV Adj Factor	0.980	0.997	0.982	0.980
Flow Entry, veh/h	456	20	368	226
Cap Entry, veh/h	1162	731	1023	1183
V/C Ratio	0.392	0.027	0.360	0.191
Control Delay, s/veh	7.0	5.2	7.3	4.7
LOS	A	A	A	A
95th %tile Queue, veh	2	0	2	1

Intersection	
Intersection Delay, s/veh	6.5
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	481	30	271	265
Demand Flow Rate, veh/h	490	30	277	270
Vehicles Circulating, veh/h	178	536	282	90
Vehicles Exiting, veh/h	182	23	386	476
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.7	4.9	6.2	4.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	490	30	277	270
Cap Entry Lane, veh/h	1151	799	1035	1259
Entry HV Adj Factor	0.981	0.998	0.979	0.981
Flow Entry, veh/h	481	30	271	265
Cap Entry, veh/h	1129	797	1013	1235
V/C Ratio	0.426	0.038	0.268	0.214
Control Delay, s/veh	7.7	4.9	6.2	4.8
LOS	A	A	A	A
95th %tile Queue, veh	2	0	1	1